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Green Capitalism or Social and Ecological Justice? Analysing Contested Green Hydrogen Developments in Chile

Jakob Rammer

Master's Thesis

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A-1090 Wien, Sensengasse 3, Telefon: (+43 1) 317 40 10
e-mail: office@oefse.at, Internet: https://www.oefse.at, https://www.centrum3.at
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Preface

The energy transition is not only topical in an European context, but has important ramification for the Global South. In his master's thesis, Jakob Rammer addresses this global dimension and provides a nuanced analysis of energy projects in Chile supported by European actors. Using the example of the emerging hydrogen sector in Chile, Jakob Rammer examines the complex interrelationships between global capitalist dynamics and local socio-ecological conflicts from a critical political-economic perspective. Building on a sophisticated theoretical framework that productively combines critical state theory, regulation theory, and political ecology, Mr. Rammer highlights the contradictions of green capitalist hegemony in Chile. Particularly noteworthy is the systematic analysis of the three competing political initiatives (export-oriented green capitalism, state-led energy transition and industrialization, social and ecological justice), which enables a nuanced understanding of the actor constellations at play. While the transition to renewable energies is important also in a Global South context, the study makes the important point that this must not lead to a renaissance of (post-)colonial extractivism at the expense of the local population and the environment.

The thesis thus makes a significant contribution to the academic and policy discussions around the global energy transition by critically interrogating the economic and ecological repercussions of new investment projects in the Global South.

Werner Raza

Director – Austrian Foundation for Development Research (ÖFSE)

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Abstract

This thesis examines contested green hydrogen (GH2) developments in Chile through a critical political economy lens, drawing upon and contributing to growing critical scholarship investigating the socio-ecological transformation of capitalism. The emergence of GH2 as a globally traded energy commodity is analyzed within the context of a contested green-capitalist hegemony project that seeks to process the multiple, interrelated crises of global capitalism through ecological modernization. The research investigates contested GH2 developments in Chile by exploring three research questions: (1) the political-economic context within which GH2 development emerges; (2) the domestic and international actors shaping Chilean GH2 policies and their roles, strategies, and interests; and (3) how conflicting actor interests materialize in concrete struggles within Chile's GH2 policy process. The thesis builds on theoretical insights from critical state theory, regulation theory and political ecology and uses historical materialist policy analysis to investigate these questions.

The findings reveal that Chile's neoliberal state with limited relative autonomy and an extraverted, commodity-based accumulation regime are central structural factors driving the state's large-scale, export-oriented GH2 strategy underpinned by extractive society-nature relations. These structures, established a strategic selectivity of the state that strongly privileges the interests of domestic and international capitalist elites. The GH2 strategy is embedded in a green-capitalist mode of development that has emerged as hegemonial in the last 10 years and aims to continue Chile's commodity-based accumulation through decarbonization and green growth narratives. GH2 development is contested by three competing political initiatives identified in the actor analysis: (1) the dominant export-oriented green capitalism initiative led by state actors, international capital, and foreign state agencies; (2) a state-led energy transition and industrialization initiative pushed primarily by labour unions; and (3) an oppositional social and ecological justice initiative led by social and environmental organizations and indigenous communities. While the dominant initiative promotes an extraverted, export-oriented development model that serves as a spatial fix for global green capitalism by displacing energy production and ecological consequences to Chile, both counter-hegemonic initiatives challenge this approach by advocating for introverted accumulation focused on domestic needs. These competing initiatives materialize in concrete struggles surrounding GH2 policies, particularly regarding accumulation dynamics, international embeddedness, and environmental regulation. These conflicts are connected to central contradictions of green capitalism, most notably the tension between the accumulation imperative and ecological limits.

The research concludes that in its current form, GH2 development constitutes a central technological fix for ecological modernization in Chile and the Global North. However, this strategy fails to address the inherent contradiction between the accumulation imperative and ecological limits and thus threatens to displace resulting consequences at the cost of local communities and ecosystems. Despite official framings of green growth, the inherent contradictions result in persistent conflicts around GH2 developments that reveal the instability of green capitalist hegemony in Chile. Importantly, the ongoing contestation by subordinated social forces upholds the potential to broaden local struggles towards counter-hegemonic projects that seek emancipatory socio-ecological transformation.

Kurzfassung

Diese Masterarbeit untersucht umkämpfte Wasserstoffentwicklungen in Chile als Beitrag wachsender kritischer Forschung zur sozial-ökologischen Transformation des Kapitalismus. Das Aufkommen von grünem Wasserstoff (GH2) als global gehandelter Energierohstoff wird im Kontext eines umkämpften grün-kapitalistischen Hegemonieprojekts analysiert, das versucht, die vielfältigen, miteinander verflochtenen Krisen des globalen Kapitalismus durch ökologische Modernisierung zu bewältigen. Die Forschung untersucht umstrittene GH2-Entwicklungen in Chile anhand von drei Forschungsfragen: (1) der politisch-ökonomische Kontext, in dem die GH2-Entwicklung entsteht; (2) die nationalen und internationalen Akteure, die die chilenische GH2-Politik (mit-)gestalten, sowie ihre Rollen, Strategien und Interessen; und (3) wie widersprüchliche Akteursinteressen sich in konkreten Auseinandersetzungen innerhalb des chilenischen GH2-Politikprozesses manifestieren. Theoretisch baut diese Arbeit auf die kritische Staatstheorie, Regulationstheorie und politische Ökologie. Historisch-materialistische Politikanalyse wird verwendet, um diese Fragen zu untersuchen.

Wesentliche strukturelle Faktoren, die die exportorientierte GH2-Strategie Chiles antreiben, sind die neoliberale Staatstruktur mit begrenzter relativer Autonomie und ein extravertiertes, rohstoffbasiertes Akkumulationsregime, gestützt durch extraktive gesellschaftliche Naturverhältnisse. Diese Strukturen tragen zu einer strategischen Selektivität des Staates bei, die stark die Interessen inländischer und internationaler kapitalistischer Eliten bevorzugt. Die GH2-Strategie ist in eine grün-kapitalistische Entwicklungsweise eingebettet, die darauf abzielt, Chiles rohstoffbasierte Akkumulation durch Dekarbonisierung und Narrative des grünen Wachstums fortzusetzen. In der Akteursanalyse wurden drei zentrale Initiativen identifiziert: (1) die dominante exportorientierte grün-kapitalistische Initiative, angeführt von staatlichen Akteuren, internationalem Kapital und ausländischen Institutionen; (2) eine Verstaatlichungs- und Industrialisierungsinitiative, gefordert von Gewerkschaften; und (3) eine Initiative für soziale und ökologische Gerechtigkeit, angeführt von sozialen und Umweltorganisationen sowie indigenen Gemeinschaften. Diese konkurrierenden Initiativen manifestieren sich in konkreten Auseinandersetzungen, insbesondere hinsichtlich Akkumulationsdynamik, internationaler Einbettung und Umweltregulierung. Die Konflikte sind mit zentralen Widersprüchen des grünen Kapitalismus verbunden, insbesondere zwischen dem Akkumulationsimperativ und ökologischen Grenzen. Entgegen der exportorientierten Strategie plädieren beide gegen-hegemoniale Initiativen für eine introvertierte Akkumulation, die sich auf lokale Bedürfnisse konzentriert und soziale und ökologische Gerechtigkeit fordert.

Die Arbeit kommt zu dem Schluss, dass die GH2-Entwicklung in ihrer derzeitigen Form einen zentralen technologischen Fix für die ökologische Modernisierung in Chile und den Globalen Norden darstellt. Diese Strategie löst jedoch nicht den inhärenten Widerspruch zwischen dem Akkumulationsimperativ und ökologischen Grenzen und droht daher, die resultierenden Konsequenzen auf Kosten lokaler Gemeinschaften und Ökosysteme zu verlagern. Trotz offizieller Darstellungen von grünem Wachstum führen die inhärenten Widersprüche zu anhaltenden Konflikten, die die Instabilität der grün-kapitalistischen Hegemonie in Chile offenbaren. Wichtig ist, dass der fortlaufende Widerstand sozialer Kräfte das Potenzial aufrechterhält, lokale Kämpfe mit gegen-hegemonischen Projekten zu verbinden, um eine emanzipatorische sozial-ökologische Transformation anzustreben.

Content

1 Introduction

In the early 2020s, central contradictions within global capitalism have manifested in a series of interrelated crises and related conflicts (Brand et al., 2024; Schneider & Syrovatka, 2024). The inherent contradiction between infinite capital accumulation and biophysical limits of global ecosystems materializes in an escalating ecological crisis that requires far reaching socio-ecological transformations and changes to global socio-economic systems to allow for future societal reproduction (Brand et al., 2021; Haberl et al., 2011). This is further complicated by the intersection of the ecological crisis with other crises, most notably the disintegration of the globalized, neoliberal accumulation regime and related geoeconomic restructuring, accelerated by the disintegration of global trade flows during the Covid-19 pandemic and the resulting economic recession (Schneider & Syrovatka, 2024). Together, the climate crisis, exploding energy prices, rampant inflation, the crisis of globalized neoliberal accumulation as well as growing power rivalries reinforcing a shift towards a multipolar geopolitical order are fundamentally altering the global economy (Tooze, 2022).

Global responses to and implications of this multi-dimensional crisis of capitalism are contradictory and spatially and temporarily specific, shaped by international competition and conflicts among social forces. These broader struggles manifest in specific social and ecological conflicts over strategies and related distribution of costs and benefits (Brand et al., 2024; Schneider & Syrovatka, 2024). The outcomes of specific conflicts have wide ramifications for the deepening or overcoming of asymmetric global power relations and for the overall emancipatory potential related to necessary transformation of global capitalism (Pichler, 2023).

A case in point is the contested emergence of global green hydrogen (hereinafter GH2) markets within the framework of the global transition to renewable energy. GH2 is positioned as a globally traded energy commodity as it can be produced from renewable energy with relatively few emissions and can be used to decarbonize hard-to-abate sectors (Pepe et al., 2023). In contrast to fossil based grey and blue hydrogen, GH2 can be produced from renewable energy with relatively few emissions. Currently, hydrogen production is strongly dominated by highly emission intensive grey hydrogen which makes up about 97% of the approximately 100Mt produced annually, largely used in fossil-related sectors like chemical industries and

refineries (Vezzoni, 2024). However, the application of GH2 and its derivatives[1] (hereinafter will be subsumed under GH2) is highly versatile and can in theory substitute the use of fossil fuels in sectors such as transport, heating and energy intensive industrial processes like steel production or the chemical industry (Scita et al., 2020). Furthermore, GH2 can be used to store energy over longer periods of time and could therefore be used to stabilize renewable energy-based electricity networks (ibid.).

The dominant production pathway for GH2 is to split water into its elements oxygen and hydrogen through electrolysis. The required electrolyser-technologies are not new, but technological innovation has been limited and production of the technologies has not yet been scaled in the required amount (Zainal et al., 2024). However, substantial improvements are being made in all four main electrolyser technologies (alkaline-based electrolysis, PEM, SOEC, and AEM). While as of 2024, electrolyser efficiency was at about 60-80% depending on the technology used, further innovations target to achieve 85-90% and also bringing about substantial cost reductions (ibid.). The versatility in both production pathways and possible applications (Staffell et al., 2019) makes GH2 an attractive technological solution for ecological modernization strategies. Such strategies aim to process certain aspects of the multi-dimensional crisis – atmospheric greenhouse gas intensity and the crisis of neoliberal accumulation – through a mix of spatial, temporal and technological fixes[2]. Consequently, building on its potential as technological fix, dominant narratives portray GH2 as a prime candidate for "green" growth, while potential social and ecological implications arising from hydrogen production and trade are sidelined (Kalt & Tunn, 2022).

1.1 Emerging Global Hydrogen Markets

The growth potential of possibly emerging global GH2 markets is highlighted in projections of international institutions such as the World Trade Organization or the International Renewable Energy Agency. Their forecasts suggest that GH2 and its derivatives could supply up to 14% of the global energy mix by 2050, with up to 25% of the 500 Mt projected demand being traded internationally (IRENA & WTO, 2023). Ambitions to benefit from this potentially

[1] Through chemical processes, GH2 can be transformed into various derivatives which are easier to store and transport and can often be used directly. Key derivatives include ammonia, which can be used as a chemical feedstock and maritime fuel, methanol, which can be used to power gas power plants, and synthetic fuels (eFuels) that can substitute fossil combustible (IRENA, 2024).

[2] Spatial, temporal and technological fixes refer to provisional solutions to the inherent contradictions of capitalism without altering the power relations and accumulation dynamics of capitalism. They rely on the restructuring or expansion of geographical spaces to resolve and/or displace crisis tendencies (spatial fix) or the delay of crises into the future (temporal fix) (Jessop, 2006). A technological fix seeks to resolve crises resulting from capitalist contradictions through technological innovation (Fox, 2023).

massive market are evident in the numerous national hydrogen strategies published in recent years (Cheng & Lee, 2022; Müller et al., 2024) and the consolidation of private sector interests within hydrogen business associations such as Hydrogen Europe or the global Hydrogen Council (Balanyá et al., 2020). The capital fractions that push global hydrogen developments are strongly dominated by fossil capital and related industries like automotive or chemical sectors who see GH2 as an opportunity to continue their accumulation models (Vezzoni, 2024). In support, major industrial producers such as China, Japan, the US, or the EU have pledged billions to promote the development of GH2 technologies, infrastructures and production capacities (Liebreich, 2023; Zainal et al., 2024). Thus, there is tight competition between major economies to advance their technological lead and capture global hydrogen supply and value chains (IRENA, 2024; Pepe et al., 2023). Furthermore, GH2 production requires intensive renewable energy inputs, leaving actors with limited production potential such as the EU or Japan looking to imports from the Global South (Noussan et al., 2021; Pepe et al., 2023).

In response to such import announcements, several states in the Global South with high renewable energy potential have positioned themselves as possible GH2 exporters (IRENA, 2024). Their motivations include the attraction of FDI inflows by leveraging their comparative advantages, the expansion of domestic renewable energy production and the related capturing of profits from GH2 exports (Pepe et al., 2023). Beyond that, potential GH2 exporters hope to turn GH2 development into a "green window of opportunity" for latecomer development and green industrialization (UNCTAD, 2023b). This is related to the so-called "renewable pull effect", meaning that the price and availability of renewable energy resources could be a decisive factor for future relocations of energy intensive industries. Countries with cheap and abundant renewable energy resources and production capacities could therefore become increasingly attractive locations for industries like steel production (Samadi et al., 2023).

Through such industrial upgrading, potential GH2 producers might overcome their subordinate position in the global division of labour as producers of commodities with limited value added (Scholvin & Kalvelage, 2025; Walker & Kalvelage, 2025). In light of this, Villagrasa (2022) argues that the possible benefits for both producer and consumer countries are "too big to set aside" (p.5) and that a just global hydrogen market is possible if profits are fairly distributed along the value chain. To that end, IRENA (2024) published a report with recommendations for sustainable and equitable development, including promoting local value creation in producer countries.

However, the substantial uncertainties, social and ecological risks, and the prevailing, highly asymmetric power relations shaping global GH2 development cast considerable doubt on such optimistic assessments. IRENA (2024) highlights that substantial uncertainties need to be overcome so that "the projected growth of the global hydrogen market (…) materialize[s] as anticipated" (p. 6). These uncertainties include high prices that make it difficult to compete with traditional fossil fuels in the short- to medium term, uncertainties related to technological maturity and certification standards, as well as slower-then-expected demand materialization (Hunt & Tilsted, 2024; Scholvin et al., 2025). As of May 2025, there is a massive gap between announced production targets and actual projects that have reached a final investment decisions (Odenweller & Ueckerdt, 2025). Public de-risking is thus deemed as a necessary stepping stone to catalyse private investments in GH2, and current developments appear to shift this financial burden increasingly to producers in the Global South (Gabor & Sylla, 2023; Scholvin et al., 2025).

This is exemplary for how framings highlighting the potential win-win character of GH2 trade often fail to adequately address underlying accumulation dynamics and power asymmetries. Furthermore, if (voluntary) local value creation does not emerge, GH2 trade structures would reproduce highly unequal trade relations in which producers export commodities and import technologies and higher-value-added goods (Müller et al., 2024; Eder and Rammer, forthcoming). Additionally, GH2 involves significant social and ecological risks related to territorial occupation and water and energy use in GH2 producing regions. Since most strategies of potential GH2 producers in the Global South are characterized by a strong focus on large-scale, export-oriented production, there is high risk that extractivist structures are deepened at the cost of local communities and natures (Müller et al., 2024).

1.2 Contested Hydrogen Developments

In this context, GH2 production in the Global South and the related economic, social and ecological implications are increasingly contested, especially at national and local levels. However, since GH2 production is only just emerging, most of these contestations evolve around the policy processes and public strategies that facilitate GH2 development. Following critical state theory (Hirsch, 2005; Jessop, 1990b; Poulantzas, 1978), such policies are embedded in and shaped by existing power relations and contested by conflicting interests of domestic and international actors and social forces (Pichler, 2023). As highlighted by Brand et al. (2024), such contestations have the potential to connect to broader emancipatory struggles shaping the social-ecological transformation. Beyond their proper transformative potential, the

analysis of specific conflicts is key to identify power relations and interests hindering and/or enabling changes that allow to transform asymmetric power relations and overcome social and ecological exploitation (Pichler, 2023). Following an initial lack of critical social-science research investigating contradictions, justice dimensions or social-ecological transformation conflicts in relation to GH2 development (Kalt & Tunn, 2022), such scholarship has expanded in recent years.

For example, Dorn (2024) investigates how in Argentina, "green" capital fractions aim to push policies towards green hydrogen production pathways but are opposed by fossil capital favouring blue hydrogen production. In South Africa, contestations have emerged between export-oriented production models favoured by big energy cooperations and foreign investors, and alternative approaches like national industrialization favoured by domestic mining, automotive, steel and chemistry industries (Kalt et al., 2023). Furthermore, local conflicts around GH2 megaprojects are another key arena for contestation, usually arising from the extensive use water, land and energy for GH2 production (Müller et al., 2024). Local resistance against such projects is mounting around the globe (Barreiro, 2023; Collins, 2024; Kalt et al., 2023; Panel Ciudadano H2 Magallanes, 2023). Their demands are often strongly related to the concepts of social and ecological justice[3], in which communities aim to regain control over their territory and relations to nature. For Colombia, Fladvad (2023) investigates indigenous struggles in GH2 transitions and briefly looks into the case of the Wayúu community in La Guajira, Colombia. The author concludes that GH2 developments in the region seem to "systematically threaten indigenous sovereignty (…) perpetuate the long and unjust history of colonial land appropriation, leading to conflict, resistance and increased militarization of the region" (p. 499).

1.3 Contested Hydrogen Production in Chile

This research aims to contribute to this growing body of critical research by investigating contested GH2 developments in Chile. Chile is a particularly interesting case for studying socio-ecological transformation conflicts related to GH2 production due to various reasons. First, the Chilean political economy is highly outward oriented and dependent on FDI inflows and commodity exports, both primarily concentrated in copper mining (Bizberg, 2019). Few large Chilean business groups and international corporations control key economic sectors such as

[3] Social and ecological justice refers to the fair distribution of environmental benefits and burdens among all people regardless of social status, while ensuring equitable access to natural resources and protection from environmental destruction for both present and future generations (Schlosberg, 2007).

mining or energy and dominate economic policy making (Bril-Mascarenhas & Madariaga, 2019). Second, Chile has become a frontrunner in renewable energy expansion following neoliberal energy reforms starting in 2014 (Furnaro, 2020) that have led to a doubling in FDI inflows to the energy sectors between 2012 and 2021 (OECD, 2023). As a result, in 2023, Chile was the 3rd most attractive country for renewable energy investment worldwide according to the Bloomberg Climatescope Index (Mitri et al., 2023).

Third, the National Green Hydrogen Strategy of Chile, published in November 2020 under a right-wing government led by Sebastian Piñera, continues this pathway. It advances corporate-driven exploitation of the country's enormous renewable energy potential for GH2 production, focusing on the solar-rich northern region of Antofagasta, and the wind-rich southern region of Magallanes. The strategy is primarily targeting exports and to a lesser extent the decarbonization of key extractive sectors such as copper mining. Following the strategies ambitious export targets, Chile is ought to turn into the leading exporter of GH2 by 2030 with a market cap of $2.5 billion USD a year and 25GW of electrolyser capacity installed that produce the worlds cheapest GH2 (Government of Chile, 2020). To that end, GH2 development should evolve in three phases: first, promoting local GH2 production and application in key areas like ammonia production, mining and refineries; second, scaling GH2 production using domestic demand; and third, exploiting "economies of scale to expand as a global supplier of clean fuels" (ibid., p. 18). The underlying objective is to develop a GH2 economy "as large as the Chilean mining sector" (Government of Chile, 2020, p. 12).

Fourth, despite a historic social uprising that brought a new center-left coalition in government, the Chilean state has strongly pushed GH2 development along the general objectives set in the 2020 strategy (Cuenca, 2024). In 2024, the government led by Sebastián Boric has published a detailed Green Hydrogen Action Plan that includes 87 state measures aimed to facilitate rapid GH2 expansion. In contrast to the 2020 strategy, the Action Plan adopts a stronger developmentalist discourse. For example, in the forewords, the Minister of Energy Diego Pardow Lorenzo argues that GH2 development has the potential for the "generation of quality jobs, the development of productive linkages (…) contributing to the economic and social development of Chile" (Government of Chile, 2024, p. 9).

Along these lines, the action plan includes measures aimed at industrial upgrading, most notably action 59 to attract electrolyser production to Chile. However, the overall commitment to corporate-driven, export oriented GH2 production is maintained. According to the Minister, Chile should leverage its comparative advantages in institutional stability and renewable energy

potential “to become a world leader in the production of this clean fuel” (Government of Chile, 2024, p. 9). To that end, the “State must create conditions of certainty and stability, facilitate competitiveness (…) and seeks to catalyse private investment” (Government of Chile, 2024, pp. 74–75). A central measure is the creation of a financial facility administered by the Chilean agency for productive development CORFO. The $1billion USD facility is a public debt to international lenders such as the World Bank and the European Investment Bank (EIB) that aims to “to reduce and mitigate financial risks of projects” (Government of Chile, 2024, p. 87).

Lastly, the state’s GH2 strategy and policy process is contested by a diverse range of actors. International institutions and foreign state actors have been strongly involved in the policy process, most notable the German development agency GIZ (Government of Chile, 2020; Quitzow et al., 2023). Multinational energy corporations, especially European capital, have shown great interest in developing large-scale, export-oriented GH2 production and control 17 out of 24 projects bigger than 100MW announced by late 2023 (H2Chile, 2023). However, the subtle changes from the 2020 strategy to the 2024 action plan indicate that social pressures had partially influenced the policy process. By late 2022, civil society actors have begun to mobilize in opposition to the large-scale, export-oriented design of GH2 production, most notably in the southern region of Magallanes (Panel Ciudadano H2 Magallanes, 2023).

Thus, the emerging Chilean hydrogen economy is strongly embedded in global capitalist developments, influenced by domestic and international actors and contested at the local and national level. However, there is a considerable lack of literature exploring these competing interests and their respective economic challenges and socio-ecological implications. So far, academic literature has focused primarily on questions of technical and economic feasibility of the currently dominant export-oriented production model (see for example: Acosta et al., 2022; Armijo & Philibert, 2020; Gallardo et al., 2021; Garcia & Oliva, 2023).

A more critical assessment by Scholvin and Kalvelage (2025) concludes that the country’s economic structure creates key barriers to GH2-based development, highlighting that Chile lacks “Schumpeterian entrepreneurship. It therefore remains to be seen whether new development paths will be inclusive, contributing to in-country development. Typical downsides of extractive industries in resource peripheries might occur” (p. 1). In another analysis of public de-risking schemes in Chile and South Africa, Scholvin et al. (2025) highlighted that the “recently introduced credit schemes could, indeed, lead to a debt trap” (p.1). Another investigation by Eder and Rammer (forthcoming) concludes that the currently emerging GH2 relations between Chile and the EU have the potential to deepen existing

relations of dependency. Furthermore, a NGO report highlights the massive infrastructure deployment in a fragile ecosystem and the enormous demand for water and mineral resources (Cabaña Alvear et al., 2023). As demonstrated, critical scholarship on contested hydrogen developments and underlying power relations is still very limited, even more so regarding emerging conflicts at the local level. This masters' thesis addresses this research gap by investigating the contested GH2 policy process in Chile with a focus on the southern region of Magallanes.

1.4 Research Questions and Structure

GH2 developments are embedded in a historically developed political context and shaped by global capitalist accumulation dynamics. Early insights suggest that current hydrogen developments in Chile threaten to deepen existing inequalities and risk decisive social and ecological implications. However, GH2 development has not yet materialized and is strongly contested, which also opens possibilities for emancipatory action towards meaningful transformative change (Pichler, 2023). This research thus investigates the political dimensions of hydrogen developments, i.e. the "economic and political structures (polity), power relations, interests, and conflicts (politics) that support or hinder transformative change as well as specific strategies and policy design (policy)" (ibid., p. 2). To explore contested GH2 developments in the global South at the case of Chile, this thesis investigates the following research questions:

- What is the political-economic context within which GH2 development emerges and how does it influence the policy process?
- Which domestic and international actors are shaping the Chilean GH2 policies and what are their roles, strategies and interests?
- How do the conflicting actor interests materialize in concrete struggles within Chile's GH2 policy process?

The thesis first establishes a theoretical framework that builds on critical political economy, critical state theory and regulation theory, and political ecology. In chapter three, the methodological framework of historical materialist policy analysis and the key research methods are discussed. Chapter four starts the analysis with an investigation of the political-economic context that shape GH2 developments. Chapter five explores the key actors and their roles, interests and strategies, to subsequently group them into political initiatives according to their common objectives. In chapter six, the key conflicts shaping the GH2 policy process in Chile are discussed. The findings are then systematised in the concluding chapter.

2 Theoretical Framework

To answer these research questions, the thesis builds on a theoretical basis provided by critical political economy (CPE). Drawing on the works of Marx and further developments, CPE captures how material and structural forces shape economic systems and capitalist societies, highlighting how class relations, production modes, and power dynamics interact and drive historical change (Jäger & Springler, 2012). The approach enables a critical analysis of socio-political contexts and offers insights into the contradictions that fuel conflicts and offer the potential for transformative change. However, as CPE is located at a rather high level of abstraction, it is complemented by a combination of critical state theory and regulation theory. Critical state theory, with its understanding of the state as a social relation and a strategic terrain through which conflicting social forces strive for dominance, offers valuable insights in the state's role in reproducing social relations within capitalism and shaping societal outcomes (Jessop, 1990b; Poulantzas, 1978). Regulation theory emphasizes how capitalist accumulation is stabilized or transformed through social and institutional arrangements (Jessop, 2002; Hirsch, 2005). The combination allows for a nuanced analysis of how the state and its actions both reflect and reproduce broader capitalist dynamics while simultaneously highlighting the potential for transformative change during crises of capitalist accumulation. Together, they offer a robust lens for analysing state action in the context of socio-ecological transformations.

2.1 Critical Political Economy

Critical political economy (hereinafter CPE) is a key paradigm of social science that builds strongly on Marxist thought, most notably laid out in "Das Kapital: Kritik der politischen Ökonomie" (Marx, 1867/1989). In contrast to mainstream neoclassical approaches to economic research, CPE rejects the artificial separation of the political and economic dimensions and rather presents an integrated approach that emphasizes the fundamental importance of social power relations in the structuring of political-economic systems. Albeit marginalized within mainstream economics, CPE was further developed in the 20th century within other social science disciplines, contributing to its transdisciplinary character and its deeper integration with other social research fields (Jäger & Springler, 2012) Thereby, the foundational arguments of CPE and its underpinning historical-materialist philosophy have become an important reference point for critical social studies and as such form the theoretical point of departure for this thesis.

2.1.1 Historical Materialism

Historical materialism represents the philosophical basis of the political-economic critique of capitalism formulated by Marx and Engels. Historical materialism departs from the observation that at the most basic level, individuals need to transform a material basis (nature) in order to reproduce, which usually requires collective work. (Social) reproduction therefore requires the social interaction among individuals and between individuals and nature, and the resulting social relations materialize in specific social structures and expressions of society-nature relations (Wigger, 2025). Thus, the relationships among human beings and between individuals and nature (re-)produce society and with it the related structures, forms of production, types of organizing, ideologies and systems of thinking, etc. (Hirsch, 2005). The totality of these structures and relations between individual actors thus constitute social systems, which develop and change over time. The structures, institutions and other (material) expressions of social relations strongly shape and are shaped by individual and collective action, which thus becomes the key driver of historical change. In essence, historical materialism argues that individual agency and the structures shaped by material conditions are dialectically related: the system is created and reproduced through the totality of individual actions, while at the same time shaping and influencing those very actions (Kofler, 2000).

As such, historical materialism rejects historical and structural determinism and instead emphasizes the transformative potential of agency: “Even though structures cannot be changed easily or immediately in the foreseeable future, neither the realms of structure and agency, nor the ideational or the material are seen as fixed” (Wigger, 2025, para. 5). This also has important implications for academic research: taking the ontological assumptions from historical materialism seriously means that critical scholarship needs to “contribute to a more comprehensive understanding of, and fundamental, change in social power relations (…) Through their commitment to social change, [critical perspectives] can also help us create a more just and egalitarian world” (Wigger & Horn, 2017, p. 51). This thesis takes that encouragement for emancipatory (research) praxis seriously by investigating the power relations and structures shaping hydrogen developments in Chile and analyse conflicts to help identify potentials for emancipatory transformation.

2.1.2 Mode of Production, Relations of Production and Social Superstructure

Building on this historical-materialist perspective, Marxist thought perceives and analyses the economy as a social relation. Drawing upon Marx' fundamental works and further developments, CPE allows for an "integrated analysis of politics, economics and society" (Jäger & Springler, 2012, p. 69) that informs the theoretical approach to this research. At the center of CPE are three fundamental concepts. The *mode of production* describes the transformation of nature through human labour to create the goods we need to reproduce, and beyond – like food, but also super yachts. This usually happens collectively, so the social relations involved determine the mode of production – with implications for power relations and distribution (Jäger & Springler, 2012). The *forces of production* describe the material basis necessary for production, like the raw materials and natural elements that are to be transformed, the human labour that would transform it and the means of production used, such as machinery (ibid.).

In that sense, the equipment, desalination plants, the water and energy needed to produce GH2 are all forces of production that are (partially) just emerging, such as new electrolyser technologies. Developments of the forces of production, for example through technological innovation, can result in changes in the mode of production. A key driver for the development of the forces of production is the accumulation imperative inherent to the capitalist system, which results from the profit-driven market-based system in which profit needs to be reinvested by capitalists to remain competitive (Wullweber et al., 2014). An example is the introduction of steam engines that catalysed industrial growth in the 19th century. GH2 development would also contribute to changes in the mode of production, for example due to the vast amounts of land and water required for production that reinforce existing and create new dynamics relating to the *commodification of nature*[4] and the (territorial) expansion of capitalism.

Developments of the forces of production also change the *relations of production*, meaning the "social forms of the organization of production" (Jäger & Springler, 2012, p. 71). The concept of classes is key here to describe specific groups and their position in the division of labour. In capitalism, the separation of society into the capital and labour class is fundamental and strongly characterized by asymmetric power relations. As explained by Wigger (2025), "the

[4] In Marxist tradition, commodification refers to the process of turning objects or things into commodities that can be bought and sold within capitalist markets. Thus, the commodification of nature describes the process of turning elements of nature (e.g. water, air, resources) into commodities. Key processes for the commodification include privatization, valorization (assigning monetary value to natural objects) and displacement (Castree, 2003).

vast majority of people sell their labour power in return for a wage while social reproductive labour is mostly unwaged, and a minority, owning the means of production, extracts surplus value from labour" (para. 9). The relations of production are embedded in and stabilized by the social superstructure – the norms, institutions, ideologies, systems of thinking and other practices, both discursive and material, that underpin and structure the (power) relations of social actors (Jäger & Springler, 2012).

Since capitalism is not a spatially isolated but global phenomena, CPE also requires paying attention to global relations of production and the inequalities and exploitation dynamics they perpetuate. According to Wigger (2025), "capitalist competition also erects hierarchies within and across geographical regions" which are "both an outcome and a prerequisite for the continuation of capital accumulation" (para. 11). The structural and ecological limits to continued profitability and accumulation in a specific geographical area require the constant expansion of capitalist exploitation to new spheres (Harvey, 2006). In fact, as argued by renowned scholars such as Arrighi (1994) or Galeano (1971), the initial development of capitalism relied on brutal processes of primitive accumulation that were at the heart of colonial appropriation. As argued by Patel and Moore (2017), the exploitation of slaves, indigenous peoples and nature in the colonized territories generated the necessary capital surplus that allowed for the emergence of the capitalist bourgeoisie in Europe. Up until today, geographically uneven development, territorial expansion and asymmetric global power relations are key characteristics and drivers of capitalist accumulation.

To conclude, a CPE-based analysis of GH2 development in Chile would encourage to investigate (the interaction of) the several key concepts mentioned: the relationship between the *forces of production* and the *relations of production*, the *social superstructure* that supports and stabilizes their articulation, as well as the spatial inequalities and uneven development produced by the capitalist *mode of production.* This means analysing how the forces of production (e.g. technology, labour, wind, water) are specifically organized through capitalist relations of production (e.g. the ownership over the projects or integration into international markets), how this interaction is embedded in a social superstructure (e.g. discourses and regulation) and, finally, how the interaction of these dimensions articulates and materializes (e.g. extractive society-nature relations or commodity export dependency). However, Marx' observations and fundamental concepts are located at a high level of abstraction. To analyse concrete phenomena and processes shaping contested GH2 development in Chile, this research thus draws upon critical state theory and regulation theory combined with concepts from political ecology.

2.2 Critical State Theory

GH2 development in Chile is strongly shaped by contested public policies that are implemented by and through the state. To analyse contested GH2 developments it is therefore central to first establish a theoretical understanding of the state. The analysis of the state and its role within capitalism have a long history within Marxist scholarship. While Marx himself did not produce a consistent theory on the state but rather touched on it during his analyses (Miliband, 1989), he emphasized that the state's characteristics result from or are strongly related to the relations of production (Jessop, 2012). According to Marx, the state protects the interests of the bourgeoise, promotes accumulation and secures social reproduction and a public order based on class relations. However, "he never wrote the 'missing book on the state'" (Jessop, 2012, p. 335), which thus left a theoretical void.

After a more practice-oriented, instrumentalist engagement with the state between the second international and the end of the first world war, Antonio Gramsci provided a highly influential and radically different theory of the state and state power (Görg & Brand, 2018). He argued that (western) state power is best understood as "hegemony armoured by coercion" (Jessop, 2012, p. 338, citing Gramsci). Gramsci's materialist analysis of the state and his conceptualization of hegemony were only published in 1960s and have since been highly influential. The publication coincided with a resurgence of the debate on the capitalist state among Marxist scholars in the early 1960s, following a break due to the 2nd World War. In this period, Nicos Poulantzas (1973/2017, 1978) published his theoretical contributions on the role of the state within capitalist societies. Poulantzas' conceptualization of the state as "the condensation of a relationship of forces between classes and class fractions" (Poulantzas, 1978, p. 132) has influenced the works of various scholars (Boos et al., 2017; Brand et al., 2007; Demirović, 2007, 2011; Hirsch, 2005; Jessop, 1990b, 1999). These highly influential works form the core of what I refer to as critical state theory.

2.2.1 The State as a Social Relation

One of the central premises of critical state theory in the tradition of Poulantzas is the conceptualization of the state as a social relation that corresponds to the broader relations of forces within a historically developed social context. According to Poulantzas, a key characteristic of the capitalist state is that it is formally separated from social relations and class struggles and thus enjoys *relative autonomy,* which however is continuously contested (Brand et al., 2007). This is necessary for the state to "perform its function as a pacifying and ordering

force“ (Demirović, 2011, p. 41) and thereby stabilizing class relations. However, Poulantzas rejects the reduction of the state to a mere instrument of the dominant classes (i.e. an instrumentalist perspective). He argues that the state “should be seen as the *material* condensation of the balance among class forces” which “actually helps to constitute that balance and does not simply reflect it” (Jessop, 1999, p. 51). The state therefore both results from and influences the (re-)production of class relations and the conditions of production, it extends and executes class struggles and its institutions are both a place of contestation and unification among class fractions and their interests. It can be conceptualized as a *strategic field* (Poulantzas, 1978, p. 168) that “constitutes a favourable terrain for political manoeuvre by the hegemonic fraction” (Jessop, 1999, p. 48). Within and through this strategic terrain, class struggles are reflected and constituted, hegemonic strategies emerge and are contested with the aim to “facilitate the creation of consensus and social cohesion, as well as to organize the power bloc through (…) means of force, law and regulations, discourses and legitimacy” (Brand, 2013, p. 432).

2.2.2 The State as a Strategic Field

It follows that, rather than perceiving the state as a uniform subject, it should be understood as an institutional ensemble which consists of several apparatuses and levels that “serve as power centres for different fractions or fractional alliances within the power bloc and/or as centres of resistance for different elements among the popular masses” (Jessop, 1999, p. 48). In other words, the strategic field in which the condensation of relations among social forces takes place materially manifests as a historically-developed institutional ensemble that, as a whole, is rather durable. Due to its dialectical relationship with broader struggles of social forces, which are reflected in its ramified composition, the interplay of the different state apparatuses is characterized by crosscutting, sometimes even chaotic, often contradictory and usually contested relations. In practice, this can mean that some information is filtered out by one apparatus or not acted upon by another, that one section takes measures which undermines decisions by the other, and so on. These processes and relations among the different state branches constitute what Jessop calls the *strategic selectivity* of a state, meaning “a bias relative to specific strategies pursued by specific forces to advance specific interests over a given time horizon in terms of a specific set of other forces each advancing their own interests through specific strategies” (Jessop, 1990b, p. 10). In the end, the interests of some forces are privileged over others, so that the highly complex relations playing out within the state “eventually map out that general line of force, the State’s ‘policy’” (Poulantzas, 1978, p. 136).

2.2.3 Hegemonic Projects and Passive Revolution

If the state is understood as a strategic field in which different actor constellations strive to dominate and shift the strategic selectivity to their favour, it is important to discuss the processes behind the creation of dominant coalitions in the state. Here, Gramsci's concepts of hegemony and the hegemonic project are highly insightful. Building on Gramsci's conceptualization of hegemony as a form of political, moral, and intellectual leadership exercised by a dominant class or class fraction, the notion of hegemonic projects refers to the attempt to secure the consent of subordinated groups by mobilizing consent behind a concrete, national-popular program (Jessop, 1983). A hegemonic project thus constitutes an attempt to articulate and universalize the interests of specific social forces, establishing a constellation of consent that stabilizes class relations and capitalist accumulation, often by allowing selective concessions to subordinate forces.

In that sense, hegemonic domination is not solely based on coercion but relies heavily on the capacity to forge alliances and organize diverse actors around specific ideological and political goals (Hirsch, 2005). The success of such a project depends on its structural embeddedness in the state form (i.e., its ability to influence the strategic selectivity of the state), its strategic coherence, and its capacity to correspond with the prevailing accumulation strategy. In cases where hegemonic leadership fails to actively mobilize popular support or integrate subordinate interests meaningfully, forms of *passive revolution* might emerge, i.e., processes of top-down restructuring that reorganize social relations while neutralizing popular initiatives and preserving the dominance of ruling groups (Gramsci, 1999; Jessop, 1983). These "revolutions without revolution" may offer limited concessions or reforms but ultimately maintain the existing power relations by marginalizing subaltern demands for transformative change.

To conclude, critical state theory allows for an understanding of the state not as a uniform actor but as a material condensation of social relations marked by internal contradictions and contested by social forces. The state is the institutionalized form of condensed relations and represents a strategic field in which conflicting social forces strive to dominate through hegemony projects, to shift the state's strategic selectivity in their favour. These insights are fundamental for capturing how state action related to GH2 development in Chile is both shaped by and shapes struggles among different actor constellations and the political projects they pursue. To situate emerging GH2 within historical capitalist developments and capture the contradictions and interaction between accumulation and social relations, I draw upon regulation theory. Regulation theory offers a systematic account of how crisis-prone capitalist

accumulation is temporarily stabilized through (formal and informal) social agreements. It provides conceptual tools to analyse the broader economic restructuring processes underpinning GH2 developments and addresses blind spots in critical state theory, particularly concerning the co-evolution of accumulation crises, state reconfigurations, and society-nature relations.

2.3 Regulation Theory

Broadly speaking, regulation theory is concerned with how capitalist and social dynamics develop and change over time and across spaces in the context of the inherently conflictive and instable capitalist system. The middle-range theory emerged in the 1970s in France and strongly builds on Marxism and CPE (Becker, 2024). Key contributors include Aglietta (2000), Boyer (1990), Görg (2003), Hirsch (2005), Jessop (1990a) and Lipietz (1987). According to Hirsch (2005), regulation theory is concerned with "how sociality, i.e. securing material provision and social cohesion under capitalist production conditions, can be possible at all and be of relative duration" (p. 84). A point of departure is the inherent contradictions and crisis tendencies within capitalism which produce conflicts that the capitalist system or state repression alone cannot resolve (Sablowski, 2014). For example, the accumulation imperative drives the exploitation and destruction of nature, which on the other hand forms the material basis of capital accumulation. Despite this inherent crisis tendency, regulation theorists observed that longer periods of stability were also possible in capitalist systems, for example during so-called Fordism from the 50s-70s. This stability cannot be explained through market mechanisms alone, neither exclusively with the executive power of the state. To achieve such a degree of stability, individual actions such as "modes of working, living, consumption as well as certain forms of pursuing interests" (Hirsch, 2005, p. 87) need to correspond with overall dynamics of accumulation.

Regulation theory provides three central concepts to analyse these phenomena. Periods of relative stability in the overall configuration of capitalist reproduction are conceptualized as *regimes of accumulation*. The concept describes the totality of processes and dynamics that underpin the accumulation of capital in a temporarily and spatially specific capitalist system (Schneider & Syrovatka, 2024). Three main dimensions of accumulation regimes are defined: extensive vs. intensive accumulation, meaning absolute value capture (e.g. increased working time) vs. relative value capture (e.g increased productivity); extroverted vs. introverted accumulation, or the orientation to global vs. internal markets; and financialized vs. industrial or productive accumulation (Becker, 2002; Schneider & Syrovatka, 2024). For the analysis of

commodity-export dependent states such as Chile, Jäger and Leubolt (2014) introduced commodity-based accumulation as a necessary extension to industrial and productive accumulation. Commodity-based accumulation can be differentiated based on "whether the resource rent (i) primarily flows abroad, (ii) is mainly captured by domestic rentiers or entrepreneurs, or (iii) is substantially appropriated by the state" (ibid., p. 180).

The stabilization of continued capital accumulation is facilitated by a *mode of regulation* (Sablowski, 2014). Regulation in that sense describes the "temporary embedding, restriction, institutionalization and processability of the contradictory and crisis-ridden dynamics of capitalism within the framework of social structures" (Schneider & Syrovatka, 2024, p. 22). In early regulation theory, five key forms of the mode of regulation had been defined: the state, international embeddedness, wage relations, the monetary restriction and competition (Boyer, 1986; Brand et al., 2024). This has later been extended to society-nature relations (Görg, 2003), which will be explored in more detail in subchapter 2.2.3. Thus, regulation does not merely refer to establishing laws but describes the "codification of one or several fundamental social relations" (Boyer & Saillard, 2002, p. 339), including norms, institutions, power hierarchies and common social practices. As explained by Hirsch (2005), capitalist regulation requires processes of dominance and exclusion:

> *"If regulation is fundamentally understood as the production of social relations and the temporary stabilization of power relations across and through existing societal antagonisms, then this necessarily occurs through a complex system of divisions of interests and social exclusions. It is primarily this mechanism that enables capitalist society to maintain its continuity despite its antagonisms and contradictions."* (Hirsch, 2005, p. 96)

A mode of regulation therefore goes beyond the executive power of the state but also requires consensus or, following Gramsci, ideological hegemony. How coercion and consensus are ultimately combined and expressed depends on the outcomes of "social and political conflicts, that stabilise and form a hegemonic system (…) that shapes the interests of the ruling and subordinate classes in conformity with the regime of accumulation" (Jessop, 2018, p. 80). This hegemonic system is the condition for the emergence of a *historical bloc* or *mode of development*, in which the relationship between the mode of regulation and the regime of accumulation is stabilized and coherent over time (Jessop, 2018). Rather than a causal connection that conditions the development of the other, the relationship between the regime of accumulation and mode of regulation should be understood as the "linking of complex and

relatively independent relationships of action and practice" (Hirsch, 2005, p. 90). These interactions are not naturally emerging, stable or linear but characterized by constant struggle among social forces and actors who seek to assert their interests and transform the accumulation regime and/or mode of regulation to their favour. As such, conflicts are the key driver of the transformation of the capitalist system and therefore a fundamental focus point for emancipatory action (Jessop, 2018).

2.3.1 Regulation Theory and the Materialist State

The spatial-institutional frame of the state is the key arena for the articulation of the mode of regulation and the regime of accumulation (Jessop, 2018). To address the complex composition of the state and its contradictory but fundamental role in the stabilization of capitalist accumulation, regulation theory needs to be complemented by critical state theory. From a regulation theory perspective, the state represents the institutional centre or, following Poulantzas (1978, p. 168), the strategic field or terrain in which the interplay between social forces and capitalist dynamics takes place. The historically specific composition of this strategic field, the degree of relative autonomy of the state and its relationship with society is a result of the historically developed social relations and accumulation dynamics. That overlaps with the assumptions from critical state theory discussed above, resulting in a state that is skewed towards the interests of dominant social forces – the states strategic selectivity (Jessop, 1990b).

The state's strategic selectivity is an important factor for shaping regulation processes, yet the ultimate outcomes of regulation processes are not controlled by the state. Rather, Jessop (2018) points out that "government decisions and measures are only one - albeit important – component" (p. 87) of the state's role in the process of regulation. Also, the state itself is shaped by regulation, creating a dialectical relationship: the state "guarantees the process of regulation with the help of its means of coercion and at the same time is itself the object of regulation" (Hirsch, 2005, p. 91). This important role of the state in societal regulation makes the state a central arena for hegemonic struggles. Its institutional power and coercive capacities allow the state to enforce the interest of dominant hegemonic projects. This is necessary, since regulation does not establish a "condition of general harmony (…) as the discourse on 'democratic civil society' sometimes suggests [but rather] remains a structure of exploitation and domination that can only be altered through social struggles and whose abolition is tied to the dismantling of prevailing societal structures" (Hirsch, 2005, p. 96).

2.3.2 Crisis, Transformation and Neoliberal Globalization

Crises in the accumulation regime and/or the mode of regulation represent windows of opportunity for hegemonic contestations. They drive dominant social actors to "seek new, more adequate strategic responses in order to manage the crises as well as to renew reproduction and domination" (Jessop, 2018, p. 78). The resulting reorganization is the outcome of political and social contestations surrounding the processing of the crisis. To understand the current crisis of the neoliberal state and the globalized capitalist system, it is therefore important to briefly examine their own emergence. Point of departure is the crisis of Fordism in the 1970s and the fundamental ramifications for the composition of the state and the interplay of social actors within it (Brand & Raza, 2003). Broadly speaking, neoliberal restructuring involved economic deregulation, increased precarization of labour, the "hollowing out" of the state (Jessop, 1994, p. 13) and an overall shift in power from the state apparatus and civil society actors towards domestic and international capitalist classes.

During Fordism, state actors were actively involved in the accumulation regime through state-owned enterprises and generally had a broader role in the economic regulation. Most notably, the state was "securing the institutional integration and social cohesion" (ibid., p. 16), actively pursuing welfare policies and promoting collective bargaining and other forms of coordination between labour unions and capital class fractions. Fordism was characterized by introverted accumulation which relied strongly on mass consumption, the intensification of production and the externalization of negative social and ecological implications (Aglietta, 2000; Boyer, 1990). This mode of development however entered crisis when various developments converged, including over-accumulation and declining profit rates, demand saturation, growing internationalization of capital, and budgetary challenges to maintain the fiscal expenses of the welfare state (ibid.)

Following the crisis of Fordism in the late 1960s and early 1970s, post-fordism slowly emerged to become the new, albeit in comparison to its predecessor less coherent, mode of development (Sablowski, 2008; Schneider & Syrovatka, 2024). This new mode of development resulted from the search for new accumulation opportunities and forms for stabilizing related social conflicts. Continued profitability was secured through the expansion of absolute value capture based on the precarization of labour underpinned by a weakening of labour unions, which led to a flexibilization of labour and a steady decline in real wages (Jessop, 1994; Sablowski, 2008). At the same time, the liberalisation of international capital and trade flows set off globalization processes that resulted in the spatial expansion of capitalism. This allowed

for the internationalization of production and a corresponding restructuring of value chains (so-called globalization), and also kickstarted global financialization dynamics and the corresponding shift from industrially dominated to financially dominated accumulation, especially in the global North (Hirsch, 2005; Sablowski, 2008). These transformations at the global level resulted in new challenges for national forms of accumulation regulation. Regulation theory conceptualizes the global capitalist system not as a fixed, centre-periphery hierarchy, but as a dynamic and evolving network of interconnected yet nationally distinct accumulation and regulation patterns (Hirsch, 2005; Jessop, 2018).

The emergence of this post-Fordist mode of development was underpinned by neoliberal ideology, which contributed to a dramatic reconfiguration of the state (Brand et al., 2008). The state was not a passive observer of these developments but the terrain in which neoliberal hegemony was advanced by dominant actors – most notably, multinational companies and international (financial) capital (Hirsch, 2005). Chile is a striking example for neoliberal restructuring, as will be explored in detail in subchapter 4.2.1. Generally, such restructuring resulted in a disintegration of the state due to privatization of state enterprises and welfare services (Jessop, 1994); the increased relevance of international markets putting "pressure on individual states to create optimal conditions for exploitation (…) in intensified competition for the attractiveness of their 'location' for cross-border, mobile capital" (Hirsch, 2005, p. 145); and finally the internationalization of the state due to the increased relevance of multinational corporations, international institutions and global social and cultural networks (Brand, 2014).

2.3.3 International Embeddedness in Regulation Theory

Globalization and the internationalization of the state under post-Fordism demands paying analytical attention to the role of international embeddedness for specific capitalist societies. Regulation theory conceptualizes the global capitalist system not as a fixed, centre-periphery hierarchy, but as a dynamic and evolving network of interconnected yet nationally distinct accumulation and regulation patterns (Hirsch, 2005; Jessop, 2018). Capitalist accumulation depends on and exploits these different patterns among states "and relies on the possibility of combining or playing them off against each other" (Hirsch, 2005, p. 104). This relationship materializes in and reproduces asymmetric power relations and structures of uneven development, imperialist competition and relations of dependency that characterize global capitalism (Hirsch, 2005). However, these relationships are also shaped by national conflicts, as the state remains the central arena for the articulation between accumulation regime and mode of regulation.

At the same time, national conflicts are influenced by and deeply embedded in global capitalist dynamics and power relations. The conditions set by dominant economies, such as production technologies, accumulation patterns, and resource demands can strongly influence the outcomes of struggles at the national level (ibid.). Thereby, subordinated states "are subjected to pressure to adapt by a dominant society and economy, which can lead to a global historical formation, that is, a certain generalization of the dominant patterns of accumulation and regulation" (ibid., p. 106). Furthermore, the global accumulation regime is also stabilized by regulation beyond the state, materialized in international institutions such as the IMF, OECD and the World Bank. These institutions both reflect and reproduce global power relations, but in a much more limited and fragmented way when compared to the state. Consequently, national accumulation strategies are embedded in a volatile international framework characterized by shifting balances of social forces and political struggles, continuously shaping the processes that reproduce inequalities and hierarchies within the global capitalist system (Jessop, 2018). Thus, capturing the specific embeddedness in global capitalism is fundamental for the analysis of the contested relationship between accumulation regime and mode of regulation at the national level.

2.3.4 Regulation Theory and Society-Nature Relations

The relationship between capitalist societies and nature received increasing scholarly attention during the second half of the 20th century. Political ecology and related fields consolidated and focused their research on *society-nature relations* – the specific ways in which societies organize, appropriate and transform nature (Brand & Görg, 2022). Starting in the early 21st century, the concept of society-nature relations and other insights from political ecology have received increased attention from regulation theorists. Especially the German regulation school has advanced the integration of ecological aspects into regulation theory (Becker & Raza, 1999; Brand & Raza, 2003; Brand & Wissen, 2011; Demirović, 1997; Görg, 1999).

Point of departure for this integration was the early observation that regulation theory "lacks a systematic treatment of social relations with regard to the interaction between society and nature, while concepts of political ecology (…) lack a critical analysis of political economy" (Becker & Raza, 1999, p. 5). This is a substantial shortcoming, given that nature not only provides the material inputs but also bears the so-called "externalities" of production processes, resulting in climate warming, ecological degradation and so-called sacrifice zones, hazardous wastelands sacrificed for the enrichment of the few. Clearly, this relationship is shaped by power relations, yet nature is often ignored in political-economic theory. To address this, the concept

of society-nature relations highlights the "dialectical relationship between social and natural processes" (Brand & Görg, 2022, p. 37) and puts increased focus on social power relations and dominance. As society's interaction is the starting and end point of capital accumulation, its analysis must be a central focal point of regulation theory.

In the regime of accumulation, nature's central role is twofold and defined by material characteristics. Most materials that are exploited for accumulation, for example minerals, are limited. So is the potential of ecosystems to function as a sink that absorbs externalities of human activities (Becker & Raza, 1999). Under capitalism, nature is an object to be exploited and utilized for accumulating value, and commodification of nature is at the heart of capitalist accumulation. It is a key characteristic of capitalist society-nature relations that materializes in different, temporarily and spatially specific, forms (Brand & Görg, 2022). To capture the central role of nature, regulation theory scholars defined society-nature relations as the sixth structural form of the mode of regulation (Demirović, 1997; Görg, 1999). Because nature is finite, Raza (2003) and Becker & Raza (1999) call this sixth form the *ecological constraint*. Görg (2003) however convincingly argues that all other five structural forms of social regulation are embedded in society-nature relations and that "all social relations are to be understood as variants of the configuration of society-nature relations" (p. 157).

Since capitalism is driven by the accumulation imperative, and therefore necessarily conflicts with biophysical limits, the interplay between accumulation, regulation and society-nature relations is characterized by conflicts. Becker and Raza (1999) describe it as followed:

> *"certain accumulation strategies require specific forms of access to specific forms of nature. Thus, the protagonists of such strategies strive for specific forms of ecological regulation. At a certain point, such regulations might lose their viability which might result in small crises that can be dealt with by minor adjustments or "great crises", which in turn open a major conflict about ecological re-regulation that contributes to paving the way to a new regime of accumulation"* (Becker & Raza, 1999, p. 10)

Such conflicts emerge on multiple levels (local, national, regional, global) and often interact with other structural forms of regulation, like social forms of consumption or production (Brand & Wissen, 2015). In capitalist societies, the regulation of society-nature relations is therefore central to stabilize accumulation by making "ecological contradictions temporarily manageable" (ibid., p. 513). This typically takes the form of temporal and/or spatial

displacements of negative consequences, as represented in the climate crisis or the expansion of commodity extraction to new territories.

A particularly violent and destructive example for the latter is the massive commodification and exploitation of nature under colonialism. A reconfiguration of society-nature relations of that scale required atrocious and oppressive power structures that were inscribed in social relations and maintained over time (Acosta, 2013; Galeano, 1971; Patel & Moore, 2017). Today, economies in the Global South, especially in Africa and Latin America, often depend on commodity extraction for exports. This is underpinned by extractivist society-nature relations deeply rooted in the historical structures of colonialism and imperialism (Acosta, 2013). Extractivist society-nature relations are enforced and maintained by dominant social forces that rely on commodity-based accumulation, and characterized by extractivism as the dominant form of accumulation (Gudynas, 2018; Svampa, 2019).

Extractivism describes the large-scale appropriation of natural resources for global markets under highly precarious conditions and tends to be highly spatialized and mono-functional, organizing entire regions around resource extraction activities (Svampa, 2019). Wealth is mostly appropriated by external actors, especially multinational corporations, while the ecological and social degradation remains in the sites of extraction, thus reinforcing patterns of dependency and ecological degradation (Acosta, 2013; Gudynas, 2018). This appropriation of natural resources at the global level is conceptualized as *ecologically unequal exchange* which materializes in the "asymmetric net flows of biophysical resources from poorer to richer countries" (Dorninger, 2024, p. 1) and is a central feature of global trade patterns. In the 2000s, neo-extractivist models sought to transform extractivism by appropriating a greater share of the rents and limiting negative consequences to some extent (Svampa, 2019). However, such attempts continued to rely on the logic of commodity extraction and failed to challenge ecologically unequal exchange, thus ultimately achieved little else but a temporal stabilization of commodity-based accumulation regimes (Gudynas, 2018; Svampa, 2019).

Violent, extractive, and imperial relations with nature are characteristic of contemporary capitalism, continuing colonial patterns under neoliberal conditions. Today, the climate crisis poses a new, truly global challenge to society-nature relations under capitalism. It represents a tightening of the ecological restriction and forces the dominant capitalist elites to find new ways of accumulation. However, while capitalist elites aim to maintain their dominant position and continue accumulation, the climate crisis does not facilitate spatial displacement and only allows temporal displacement to a certain extent – as seen in the rapid deterioration of climate

stability in the early 2020s. The exploration for new forms of accumulation and regulation thus creates several fields of conflicts, that also open opportunities for emancipatory contestation (Brand et al., 2024). The highly contested regulation of social-ecological transformation processes to manage the climate crisis is therefore a key focus point of this analysis.

3 Methodology

GH2 developments in Chile are strongly disputed and shaped by a contested policy process. Policies are regulatory interventions implemented by and through the state (Pichler, 2023), but they go beyond functionalist, codified acts of law. Building on the insights of the theoretical framework just discussed, policies are part of and embedded in broader processes of societal regulation which aims to stabilize the inherent contradictions of capitalist accumulation regimes. Social forces compete to shape societal regulation according to their interests, and the state, as the material condensation or institutionalized form of the relations between actors, is a central field or terrain for such conflicts. Policies, as a particular, institutionalized form and mechanism of societal regulation, are a possible outcome of the struggles among social actors. The policy process then describes the whole course of this conflict, starting with its embeddedness in a historically developed context and its ignition resulting from a specific contradiction within the accumulation regime, to the contested definition of the conflict's core issue and objective, the negotiation and formulation of concrete measures and actions and lastly their implementation. This study focuses particularly on how the political-economic context, the diverse interests of involved actors, and the resulting conflicts influence current GH2 developments in Chile. The analysis is guided by the historical-materialist policy analysis approach (hereinafter HMPA), which aims to operationalize these highly abstract and complex interactions and to that end, provides a productive blueprint for analysis.

3.1 Historical-Materialist Policy Analysis

As institutionalized forms of societal regulation, policy analysis is a key part of political-economic analysis and therefore also highly relevant for questions related to international development. HMPA as a specific approach to policy analysis was first developed by Brand (2013). Brand's innovation was motivated by the shortcomings of classical approaches like rationalist approaches to policy analysis but also of more critical approaches like interpretative policy analysis (IPA). Mentioned shortcomings of rationalist approaches are their technocratic, functionalist understandings of policies, and their tendencies to sideline actor interests and power relations. IPA addresses the latter shortcoming by paying stronger attention to the contested social constructions of discourses, meanings, ideas and knowledge, and the power relations underpinning these processes (Greven, 2008). Sharing both normative orientation and emancipatory aspiration, IPA to Brand (2013) constitutes a "a good reference point for an HMPA" (p. 430). In contrast to IPA, however, a historical materialist approach to policy analysis

pays more attention to the role of policies in societal reproduction and "offers a more sophisticated understanding of the context and corridors of policy-making, as well as of the inertia of the objects of policy intervention" (p. 426).

This different and more complex approach results from HMPA's holistic understanding of society, social interaction and societal reproduction which is grounded in historical materialism. Historical materialism, based on my more detailed discussion in subchapter 2.1.1, analyses the dialectical relationship between material conditions and social relations, emphasizing the dynamic interplay between agency and structure in shaping societal change. The "historical" refers to the understanding that social systems and structures are not static but evolve through time via transformative human action and struggle. In relation to policy analysis, this means that policies need to be understood as contradictory outcomes of conflicts among social actors that are susceptible to change and transformation. The "materialism" highlights that the basis of social life lies in material conditions which shape and are shaped by contested social relations. This contradictory interplay condensates in material structures that determine the organization of labour, production, and human interaction with nature. Therefore, policy analyses need to pay attention to historically developed social structures characterizing the specific political-economic contexts in which policies emerge. Building on the dialectical approach of historical materialism, HMPA thus pays specific attention to how asymmetric and instable power relations and competing material interests among actors shape and are shaped by historically-specific social structures (Brand et al., 2022). HMPA is therefore primarily interested in how policies emerge in the context of contested actor interests and to what extent they shape and stabilize societal reproduction and regulation (Schneider et al., 2023).

Since these processes are highly complex and located on a high level of abstraction, Brand et al. (2022) suggest retroduction as a "bridge between theoretical concepts and adequate tools to investigate policies (…) such as interviews, [or] document analysis" (p. 286). Retroduction combines inductive and deductive moments as it encourages researchers to circulate between empirical fieldwork and data-gathering (inductive) and theoretical analysis of that data (deductive). This is then repeated, so that "In an iterative process previous concepts are then again refined through empirical insights, explanations are altered and existing theory is reconstructed" (Brand et al., 2022, p. 287). To further facilitate analysis, early refinements to HMPA focused on its operationalization. A key contribution was the introduction of the three-step-process to HMPA by Buckel et al. (2017) and Kannankulam and Georgi (2014). The proposed three steps are context analysis to capture the political-economic context and existing

social structures, actor analysis to investigate the relations of relevant actors, their competing interests and struggles, and lastly process analysis to capture the course of policy development and the key changes and turning points throughout. I decided to rather focus on the context and actor analysis and establish a deeper understanding of the political-economic conditions, contested actor interests and key conflicts.

3.1.1 Context Analysis

The objective of context analysis is to capture the structural and historical conditions under which specific policy conflicts emerge. From a historical materialist perspective, policy processes are viewed not as neutral mechanisms state action, but as arenas where competing social forces negotiate, contest, and attempt to stabilize the inherent contradictions of capitalist societies (Brand et al., 2022). Context analysis reconstructs a policy as the outcome of a conflict shaped by historically specific constellations of material conditions and social relations (Kannankulam & Georgi, 2014; Schneider et al., 2023). Regulation theory is particularly insightful for that, as it enables a historical analysis that examines the interplay between crises in accumulation regimes and their processing through the establishment of forms of societal regulation, such as policies (Jessop, 2018).

The context analysis allows researchers to connect specific policy struggles – such as those around GH2 development – with broader contradictions within capitalist social relations, like those between the accumulation imperative and the ecological limits. It further highlights how different social and political actors respond to these contradictions in conflicting ways, depending on their material interests and power relations with other social forces (Brand et al., 2022). In that, critical state theory provides important theoretical grounding with its conceptualization of the state as the materialization of social relations. Based on that, the state apparatus is the central institutionalized form for policy formulation, and as such resembles strategic terrain in which conflicting actor interests compete for dominance (Jessop, 1999). Ultimately, context analysis within HMPA does not merely describe background conditions but seeks to uncover how structural tensions give rise to political contestation and policy development.

In relation to GH2 development in Chile, my context analysis seeks to explore the broader historical developments and key characteristics that shape the political-economic context in which GH2 production emerges. Building on regulation theory, I investigate the evolvement of the relationship between accumulation regime and mode of regulation in Chile and how these

developments were shaped by and shaped the form and strategic selectivity of the state as well as society-nature relations in Chile. Starting with the neoliberal counter-revolution led by Augusto Pinochet, my context analysis follows a chronical approach that focuses on crises and their processing through hegemonic struggles until the recent emergence and consolidation of a green-capitalist mode of development in Chile. My goal with this detailed historical exploration of the power relations, structures and dynamics is not only to analyze their relation to GH2 developments, but to establish a sound understanding of Chilean capitalism for further research on social-ecological transformation struggles in Chile.

3.1.2 Actor analysis

The objective of the actor analysis is to uncover the conflicting interests, roles and strategies of political actors, related to the broader capitalist social relations. It begins by identifying the relevant actors involved in the policy conflict and analyzing their specific interests, strategy preferences and involvement in the policy process (Brand et al., 2022; Schneider et al., 2023). In a next step, actors are clustered into groups or coalitions based on shared objectives and/or strategies. Scholars such as Buckel et al. (2017) and Kannankulam and Georgi (2014) propose to group actors with common strategic orientations into hegemony projects (Brand et al., 2022, p. 285). Hegemonic projects refer to the efforts of dominant social forces to organize political, intellectual, and moral leadership by mobilizing consent around a national-popular program that asserts a general interest while actually advancing actor-specific long-term interests (Jessop, 1983, p. 100).

However, following Syrovatka (2016), Brand et al. (2022) argue that it is analytically more productive to first group actors into political projects or initiatives based on concrete interests within (parts of) policy struggles and only in the next step relate them to broader hegemonic projects. Recent insights from HMPA demonstrate that actors' strategies within concrete policy conflicts often do not immediately aim at establishing hegemony at the societal level. Political initiatives, in contrast, often pursue more localized or technical influence, only subsequently contributing to broader hegemonic projects where conditions permit (Brand et al., 2022, p. 286; Syrovatka, 2016). Thus, rather than presuming ideologically coherent hegemonic projects, this approach emphasizes empirical reconstruction by first relating actors according to the alignment of their interests and strategies, and only then connecting them to broader hegemonic struggles (Syrovatka, 2016). This is important to avoid assuming ideological coherence within actor coalitions and instead encourages researchers to pay attention to dynamic developments during the policy process, that can even involve drastic changes of interests and alliances.

Nevertheless, it is crucial to ultimately relate actor coalitions to broader hegemony contestations to go beyond a mere mapping of actor interests and instead highlighting how material conditions, inherent contradictions and competing social forces interact at a broader level.

Chilean GH2 developments involve a broad network of domestic and international actors which include state actors such as ministries or agencies, private actors like energy corporations or investors, international organizations and foreign state actors, and civil society actors such as indigenous communities. These actor groups are not homogenous in terms of interests and strategies but can also involve opposing perspectives, in this case especially among state actors. Given the high number of actors involved, I first tried to identify key actors for closer analysis but also left room for later adjustments and expansions. However, given the limited scope of this research and constraints relating to the availability of interviews, I had to compromise and exclude certain actors.

3.2 Research Methods

To analyse contested hydrogen policies in Chile, I primarily employed qualitative research methods. This choice is based on two central reasons. First, as discussed in the state of the art, GH2 development in Chile is unfolding in a highly dynamic and emergent process, limiting the availability of consistent and systematic data. Second, qualitative methods are particularly suited for social science research that seeks to empirically investigate specific actor interests, uncover power relations, and identify contradictions that would be difficult to capture through quantitative approaches (Mohajan, 2018). Moreover, qualitative methods require deeper involvement in the analysed field, which facilitates the identification of unexpected connections and hidden interests – an essential aspect for conducting HMPA, especially with regard to actor analysis (Brand et al., 2022). A further, albeit secondary, reason for the focus on qualitative methods lies in the limited scope of this thesis. While mixed-methods approaches can generate broader insights or even contrasting results, the restricted timeframe and data situation make a qualitative approach more appropriate here. Quantitative methods will be considered in future research when broader scope and greater data availability permit it.

To answer the research questions for this thesis, I combined a comprehensive literature review with a qualitative content analysis of key official documents and 15 semi-structured interviews. Qualitative content analysis was employed as the central analytical strategy for both interviews and documents, providing a structured approach to exploring arguments, actor interests, and areas of conflict (Mayring & Fenzl, 2019). The prioritization of methods varied

depending on the analytical step: for contextual analysis, I relied primarily on the literature review and to a lesser extent on content analysis; for the actor analysis, I primarily drew on the qualitative content analysis of key strategic documents and semi-structured interviews. Building on this methodological foundation, the following section outlines the specific operationalization of the research process, including the selection of documents and interview partners, the development of the coding scheme, and the procedure for conducting the qualitative content analysis.

3.2.1 Interviews and Documents

Following an initial literature review, I identified the two key strategic documents published by the Chilean state regarding GH2 development. The first is the National Green Hydrogen Strategy, published in 2020 under President Sebastian Piñera, which outlines the general approach, motivations and objectives for GH2 development in Chile. The second document is the Green Hydrogen Action Plan published in 2024 under President Boric, which includes 87 concrete state actions to facilitate GH2 development in accord with the overall approach and objectives outlined in the 2020 strategy. These documents are essential as they represent the outcome of concrete early struggles and compromises within the state, as well as the political projects pursued by the state apparatuses under the respective governments.

In the selection of interview partners, I focused on stakeholders involved in GH2 development and the related policy process. Contested GH2 developments in Chile resemble the material condensation of domestic and international actor interests and strategies. Relevant actors thus span the local, national and global level. For the identification of actors, I started with a broader categorical differentiation into state/institutional actors, business actors and social actors. Through a comprehensive literature review I identified a first broad selection of actors with interests potentially relevant to the policy process, which is listed in **table 1**.

Table 1: Relevant Actors for GH2 Development in Chile

Actor Category	Domestic	International
State & Institutional Actors		
Institutions	Ministries of Energy, Economy, Environment	EU Commission, EIB, World Bank, IMF, WTO
Agencies / Organizations	CORFO, ProChile, SEA, InvestChile	GIZ, IRENA,
State-Owned Companies	ENAP, CODELCO	EDF
Business Actors		
Investors / Project Developers	Consorcio Austral, Colbún	HIF, HNH Energy, Engie, Enel, Total
Lobby Groups	H2Chile, H2Magallanes, Consejo Minero, SOFOFA	Hydrogen Europe, Hydrogen Council
Other Corporations	-	HInicio, Enaex, SIEMENS, Air Liquide, Maersk, Porsche, AngloAmerican
Social Actors		
Civil Society Actors	ACUE, FIMA, OLCA, Panel Ciudadano H2 Magallanes, CASA, Kawésqar	Powershift, Greenpeace, Heinrich-Böll Stiftung, Rosa-Luxemburg Stiftung
Labour Unions	CUT Chile, Sindicato ENAP	IG Metall, IndustriALL, TUED
Academic Actors	Universidad de Chile, Universidad Católica	University of Hamburg

I then refined my selection following the first interviews, narrowing down my selection on actors that are actively relevant to the policy process and sidelining those with limited actual involvement. At the same time, I aimed to capture and balance the full diversity of actors, perspectives and interests. Lastly, I selected additional interview partners with central stakeholders after I had completed the majority of the interviews, based on the information obtained. In total, I conducted 32 interviews that I conducted prior to, during and after a research trip to Chile in September 2024 in two main phases: a first phase in May and June 2024, and a second, more relevant phase in September and October 2024. In Chile, I spent two weeks in Santiago and two weeks in Magallanes. The interviews were held in German, English and Spanish, depending on the preference of the interview partner. I transcribed the interviews using the software TurboScribe and translated selected paragraphs using ChatGPT, which I then controlled and corrected where needed. Since some interview partners requested anonymity, I decided to anonymize all interview partners.

The interviews were structured along three categories deductively derived from my theoretical basis and the two-step operationalization of HMPA, and included: political process, interests and motives, conflicts and cooperation, distribution of costs and benefits and international embeddedness, with about four to six broader questions for each category.

Through the semi-open interview guide, I was able to encourage free narration without allowing the conversation to stray too far from the research topic. In developing the guide, I followed the principle of "as open as possible, as structured as necessary" (Helfferich, 2014, p. 560). I prepared a general interview guideline that I adapted according to each category (to be found in the appendix) and, when needed, further adapted it for individual actors. Since I conducted the interviews in two main phases, I was able to revise my interview guidelines after first results. Following a retroductive process as suggested by Brand et al. (2022), I contrasted my empirical findings with the theoretical basis and then refined the guideline accordingly.

Ultimately, I chose 15 of the 32 interviews (see the list in the appendix) for my analysis, as this allowed me to balance requirements for comprehensiveness and scientific diligence with the overall timeframe, scope and adequate qualitative standard of a master thesis. In the selection, I first prioritized relevance and inference in the policy struggles and only then content and expressiveness, balancing that to reflect the broader actor categories. Ultimately, the list involves two business representatives that pertain to international corporations and investors developing GH2 projects in Chile; four social actors, two of them local actors from Magallanes (an indigenous community leader and a local NGO representative), and two from the national level (a high-level official from CUT Chile and a researcher on Energy Politics from Universidad de Chile); five domestic state actors, two of them officials from local agencies in Magallanes (CORFO, SEA) and three high-level officials in Santiago (Ministry of Energy, ProChile, CORFO); and, lastly, two international actors (GIZ, World Bank).

3.2.2 Qualitative Content Analysis

Following Mayring and Fenzl (2019), qualitative content analysis is a rule-based method aimed at drawing inferences beyond the text itself by systematically assigning categories to text segments. It requires a clear definition of coding units to ensure analytic precision and emphasizes a rigorous coding process involving a pilot phase and strict adherence to coding rules in the final analysis. The method's reliability is guaranteed by quality criteria to ensure the stability and replicability of the coding procedure (Mayring & Fenzl, 2019, p. 636). During the coding process, "data are broken down, conceptualized, and reassembled in new ways" (Strauss & Corbin, 1990, p. 39), with the objective to systematize data so it can be structured, condensed and made comparable for the analysis.

To that end, collected data (in my case, interview transcripts and official documents) is split into categories and codes. These categories and codes can be derived inductively, i.e. based on

the empirical findings, or deductively, i.e. based on theories and concepts (Mayring & Fenzl, 2019). Following Brand et al. (2022), I applied the method of retroduction and combined the inductive and deductive approach. In a first deductive step, I established a broad coding system based on the interview guide and the theoretical framework. I then established another coding system based on a thorough reading of selected transcripts, a subsequent grouping of text contents and a resulting inductive identification of categories and sub-categories. The two coding systems were then incorporated, combined and revised. After a pilot phase, the coding system was further refined to create the final coding system for the analysis of the collected data. For the coding process, I used the software MAXQDA and largely followed the recommendations by Rädiker and Kuckartz (2019).

3.3 Reflections on Methodology

3.3.1 HMPA and Operationalization

The application of historical materialist policy analysis was highly insightful but also extensively complex and abstract. On the one hand, this resulted in several moments where I encountered it very difficult to navigate these complexities and relate my empirical findings to my abstract theoretical concepts, resulting in moments of utter confusion. On the other hand, it allowed me to develop a fundamentally different and much more comprehensive understanding of GH2 developments in Chile. For example, I changed from a theoretical perspective more strongly focused on international dependencies towards a stronger focus on capitalist regulation of crises by incorporating regulation theory, to explain certain empirical findings and relate GH2 to broader struggles. This certainly complicated my research endeavor, which in retrospect, went well beyond the timeframe and resources adequate for research of this scope. In addition, and related to these difficulties, it is important to highlight limitations regarding data depth and reliability resulting from the dynamic and under-researched field. Yet, I was able to approximate reliability by drawing on and comparing insights from documents, literature and interviews.

3.3.2 Positionality as Researcher from the Global North

Reflecting on my positionality as a researcher conducting fieldwork in the Global South was a central aspect during my research design and throughout the research process. My ability to undertake this project stems from a privileged position – not only as a white person from the capitalist core but also as a man that was able to study at university. These points first and

foremost allowed me to do the field trip that was indispensable to my research objective due to the lack of literature and quantitative data. My privileged position also made it significantly easier and safer to organize and carry out an independent research trip without institutional support. Furthermore, the research also contributes directly to building my professional academic career, which obviously creates a personal interest that goes beyond knowledge-building. Acknowledging this positionality and the power dynamics it entails; I aimed to highlight power imbalances and prioritize the perspectives of marginalized groups and subordinated actors in my research.

In practice, I prioritized local forms of knowledge by giving more room to interviews with local actors, intervening less during these interviews, and also engaging with these actors beyond the interview. A key motivation for my research is to not only study how local, national, and global asymmetrical power relations and structural inequalities are (re-)produced through GH2 development in Chile, but also to engage in emancipatory practices aimed at supporting alternative pathway. I remained in contact with opposing actors to connect their struggles with developments in Austria. In January 2025, I was able to organize the participation of a Chilean environmental activist in the International Conference on Resource Politics for a Global Just Transition in Vienna. Furthermore, I shared insights from my research in an online event organized by the Panel Ciudadano H2 Magallanes in Chile. Also, I am currently writing a peer-reviewed journal article that further investigates opportunities and barriers for transformative change related to contested GH2 development in Chile, that will also be translated to Spanish. Through such engagements, I try to utilize my privileged position and access to resources so that my work can hopefully contribute to emancipatory struggles and social-ecological justice.

3.3.3 Field Research in Chile

Conducting fieldwork in Chile proved to be a crucial component of this research, as it allowed me to develop a much deeper and more nuanced understanding of the territorial materialization of power structures, contested local and national society-nature relations, and the entrenched structural inequalities that characterize Chile. However, it also presented significant challenges. Investigating power relations and emerging socio-environmental conflicts while they were actively unfolding, and while I myself was embedded within these dynamics as a foreign researcher, required a high degree of reflexivity. It demanded constant awareness of my own influence on the research, and I had to pay attention to the different settings, critically assess the information shared with me and be cautious about the information

I shared. For example, it was difficult to navigate to what extent and in which ways I can share information about business interests with civil society actors. This was further complicated by the limited timeframe for my field trip. One month was a very tight timespan for the 23 interviews I conducted – in a country I had never been to before. Even though I managed the high workload well thanks to my extensive preparation, more time would have been helpful to gain further insights and experiences beyond the interviews.

Language posed an additional challenge. Although I had dedicated two years prior to the research trip to improving my Spanish – especially academic Spanish relevant to the field and social sciences – the Chilean variant of Spanish, which is commonly considered a particularly difficult dialect, did indeed challenge me. While I was able to perfectly handle most of the interview situations, I encountered some, albeit limited, difficulties in everyday interactions. In a few cases, this also occurred during interviews, and the subsequent analysis revealed minor misunderstandings in some specific situations. At last, that did not negatively affect the overall research but still motivated me to further improve my (Chilean) Spanish proficiency before the next research. Overall, the fieldwork experience underscored the complexity of researching evolving power structures in a dynamic setting and the importance of linguistic and cultural preparedness.

3.3.4 Interviews as Research Method

The use of semi-structured interviews as the primary method for empirical data collection proved to be highly effective for this study. Semi-structured interviews enabled me to obtain insights that would have otherwise remained inaccessible to external observers, particularly regarding subtle power relations between actors and rather inconspicuous conflicts in the GH2 sector. The open yet guided structure of the interviews allowed for a balance between uncovering new, unexpected information and ensuring that the discussion remained close to the core research topic. Nevertheless, obtaining meaningful responses proved challenging in certain cases, particularly with representatives from state institutions and private corporations, who often reproduced formal institutional narratives rather than offering critical or personal perspectives. This limitation was partly due to a lack of established networks, especially at the outset. Furthermore, for state actors, I used the official platform “Ley del Lobby”, which proved extremely helpful to access state officials for interviews but those always took place in quite official settings – further complicating my endeavour to get behind institutional framings. Another methodological limitation was the restricted amount of time available for each

interview, which, given the breadth and complexity of the research topic, sometimes made it difficult to explore all relevant dimensions. However, over the course of the fieldwork, I became more effective in steering conversations back to the central themes without disrupting or being offensive. Also, I developed strategies that allowed me to at times get behind institutional narratives, such as posing pressuring questions at the right moments. Such improvements highly motivated me for further field research in the future.

2.1.1 Qualitative Content Analysis

The analysis of collected data was conducted through qualitative content analysis, following the approach outlined by Mayring and Fenzl (2019). Practical software tools such as Turboscribe for transcription and ChatGPT for translation proved very helpful, although careful manual revision and correction was indispensable to ensure the accuracy and reliability of the outcomes. For developing the coding system, the combination of a deductive and inductive approach allowed for both theoretical awareness and empirical openness, which resulted in a coding system that required no major revisions during the analysis. Following a systematic and rule-guided process as outlined by Mayring and Fenzl (2019) ensured reliability and validity of the qualitative content analysis. However, it is important to emphasize that both the material analysed and my role as a researcher are embedded within broader power relations and influenced by specific interests, biases and motivations. For example, the insights of ministry representatives are strongly influenced by institutional relations and constraints and could maybe involve the interest in drawing a nicer picture of GH2 development. I as researcher also approach this topic from an emancipatory and activist approach, which for example contributed to a more critical interpretation of the discourses of business actors vis a vis civil society actors. However, following a critical realist epistemology (Bhaskar, 1975; Buch-Hansen & Nielsen, 2020), objectivity is neither achievable nor desirable; rather, it is fundamental to acknowledge and highlight the own positionality and other subjective dimensions of the research process.

Overall, the combination of critical reflexivity, in-depth fieldwork, adaptive interviewing strategies, and systematic qualitative content analysis enabled me to critically explore the contested politics of green hydrogen development in Chile, despite the challenges and limitations I encountered.

4 The Political-Economic Context of GH2 Development in Chile

GH2 development in Chile is embedded in global capitalist power relations and shaped by temporally and spatially specific interactions of accumulation regimes, modes of regulation and society-nature relations. If GH2 should become a globally traded energy commodity as envisaged by powerful public and private actors, it would reconfigure society-nature relations through commodification processes, extractivist and infrastructural expansion and the establishment of new commodity frontiers. Ultimately, however, the extent and form of GH2 development depends on the struggles among actors, struggles that are shaped by the specific political contexts in which they occur. This first part of the analysis thus investigates the political and economic context of contested GH2 developments in Chile. Before turning to the local and national level, the following section analyses how GH2 developments in Chile are influenced by and embedded in power relations and contradictions that shape the contested green-capitalist project at the global level.

4.1 Global Context

4.1.1 Green Capitalism as a Global Hegemonic Project

The development of a global GH2 market is embedded within contested strategies that seek to process the ecological crisis and the crisis of globalized, neoliberal accumulation. These strategies seek to arrange contradictions and conflicts between the ecological crisis with new and old accumulation dynamics. Starting in the late 2000s and early 2010s, a green capitalist hegemony project emerged, promoted initially by political and capitalist elites in the Global North in response to the 2008 financial crisis and the accelerating climate crisis (Brand & Wissen, 2015). Green capitalism relies strongly on the ecological modernization of capitalist accumulation along the lines of ‘green’ growth (Brand et al., 2024).

According to Brand et al. (2024), a green-capitalist accumulation regime is not (yet) observable since the green-capitalist project remains highly contested, for example from fossil capital fractions, and is only selectively implemented across time and space. Nevertheless, by the late 2010s, green-capitalist strategies have consolidated as hegemonial forms for processing the climate crisis while maintaining capitalist accumulation. This is most evident in the massive green-capitalist reform packages presented by key actors in the Global North, like the European

Green Deal in 2019 (Vela Almeida et al., 2023), the Green New Deal proposed by US Democrats Alexandria Ocasio-Cortez and Ed Markey which influenced the later Inflation Reduction Act (Huber, 2022), or the ongoing 14th five year in China (UNCTAD, 2023a). Furthermore, key international organizations such as the United Nations (UN), the International Renewable Energy Agency (IRENA), the World Bank or the International Monetary Fund (IMF), as well as central international agreements like the Paris agreement in 2015 embrace green-capitalist strategies.

Central to ecological modernization within green capitalism is the assumption to tackle the climate crisis through the decarbonization of economic systems. This however reduces the ecological crisis to a crisis of greenhouse gas emissions. As pointed out by Brand et. al. (2024), it is an inherently unstable strategy, because its reductionism ignores other aspects of the ecological restriction, i.e. the physical finiteness of the material conditions of accumulation. Ecological modernization and "green" growth strategies rest on the illusion of decoupling of economic growth from the exploitation and destruction of its material basis (Brand & Wissen, 2018). A growing body of research provides hard evidence that this naïve assumption is not in line with ecological restrictions (Dorninger, 2024; Dorninger et al., 2021; Haberl et al., 2020; Hickel & Kallis, 2020).

In contrast, the ecological modernization of capitalist economies requires continued and even intensified expansion of ecologically destructive accumulation (Dorninger, 2024). This contradiction is temporarily stabilized by a mix of spatial, temporal and technological fixes. For example, the import of GH2 from the Global South combined with mechanisms such as the EU's carbon border adjustment mechanism (CBAM) ensure that the social and ecological consequences and economic adjustment costs are displaced to the Global South (Müller et al., 2024; Tandon & Le Merle, 2024). This ultimately allows states in the Global North to decarbonize while also maintaining ecologically destructive levels of consumption (Brand & Wissen, 2015, 2018). The increasing appropriation of material inputs for decarbonization from the Global South is therefore intensifying ecologically unequal exchange and deepening related historical injustices (Dorninger, 2024).

Yet, several states in the Global South have rapidly adopted green-capitalist energy transition strategies and/or position themselves as key exporters of material inputs required for decarbonization (Gudynas, 2024). According to Gudynas (2024), this development is underpinned by a mix of imposition and influence of the strategies promoted by political and capitalist elites in the Global North, but also through their imitation by local elites. The

intensification of ecologically unequal exchange is regulated by what Bringel and Svampa (2024) describe as *decarbonization consensus*. They argue that this consensus constitutes "a global agreement that advocates for a shift from a fossil fuel-based energy system to a carbon-free (or low-carbon) energy system based on 'renewable' energy" (p. 243). According to the authors, this consensus is characterized by energy colonialism, primarily pushed by large corporations and governments in the Global North, so to stabilize the systematic exploitation of communities and natures in the Global South. This materializes in discourses of *green extractivism* – "a non-ideological reframing (neither left nor right) of commodity extraction [as] inevitable for saving the planet" (Dorn et al., 2022). Underpinned by the decarbonization consensus and green extractivism, green-capitalist strategies are fundamentally altering society-nature relations and lead to the creation *green sacrifice zones* in the Global South (Zografos & Robbins, 2020) where the lives, needs and interests of people are sidelined for the sake of "green" accumulation (Bringel & Svampa, 2024).

Ecologically unequal exchange and the related escalation of social and ecological consequences for local communities is further deepened by intensified geopolitical competition (Dorninger, 2024; Dorninger et al., 2021; Hickel et al., 2022). In parallel to and strongly interlinked with the emergence and consolidation of green capitalism, global geoeconomic[5] and geopolitical competition intensified throughout the decade (Lee et al., 2018). Following regulation theory, these developments are the consequence of historical developments of accumulation and regulation. In the 21st century, sluggish growth and a declining productive base in the former capitalist centre (i.e., the EU and US) was met by rising productivity and exports in China which aggravated global competition for limited global destination markets (Sablowski, 2021). China's increasingly dominant role in global markets was accompanied by more assertive foreign policies and international initiatives aimed at expanding its economic network by integrating other states (Callahan, 2016; Wang, 2016). These developments further transformed the existing capitalist order and undermined western political-economic dominance, contributing to global restructuring and the emergence of a new global capitalist order marked by competition among super-power blocs (Friedberg, 2023; Ji, 2021; Vivoda et al., 2024).

[5] Geoeconomic power refers to a state's strategic use of economic instruments to pursue geopolitical objectives, preserve or enhance relative power, and advance zero-sum interests beyond the logic of mutually beneficial trade (Haroche, 2024).

Following regulation theory, interstate competition ultimately aims to establish control over global capitalist accumulation processes and their regulation, and therefore strongly shapes conflicts within the green capitalist project. This materializes most notably in contestations for dominance over existing and new accumulation opportunities central to ecological modernization, such as the increasing geopolitical competition for "green" energy and related technologies (Lachapelle et al., 2017). Similarly, the EU, China and the US are competing for technological lead in the production of electrolyser technologies (Pepe et al., 2023). Another example is the intensified competition for so-called critical minerals (Vivoda et al., 2024). This "Global competition to secure access to critical materials is reconfiguring extraction frontiers, fueling resistance and creating tension on both globalization and deglobalization dynamics" (Walter et al., 2024, p. 1). Current trends also suggest that those regions that look back at centuries of colonial exploitation, especially Latin America and Africa, are the primary targets of global competition for commodities and the related intensification of green extractivism and ecologically unequal exchange (Boafo et al., 2024; Dietz, 2024; Gudynas, 2024; Kalt & Tunn, 2022).

However, some authors question the usefulness of 'green colonialism' for conceptualizing the (re-)configuration of relationships in global capitalism. For example, Dorn (2022) urges scholars to "go beyond the North-South dichotomy", given that "the geographies of decarbonization are significantly more complex and shaped by multiple actors, policies, and strategies" (p. 137). The author argues that this is fundamental in order to avoid structural simplification or playing down agency (Dorn, 2022). Similarly, Brand et al. (2024) emphasize the transformative potential of agency in using the ecological crisis as a window of opportunity for emancipatory action. Therefore, although existing dependencies and asymmetric power relations are likely deepened by green-capitalist accumulation, specific developments and struggles need to be studied case by case. This is even more important for green hydrogen, which is only just emerging as a globally traded commodity that creates many uncertainties but also possibilities for the various actors involved. The following section will elabourate in detail to the structural characteristics and context specific to green hydrogen, so to establish the basis for the analysis of key conflicts shaping green hydrogen development in Chile in the subsequent chapter.

4.1.2 Emerging Global Green Hydrogen Markets

The development of a global GH2 market is a technology fix central to ecological modernization strategies embedded within green capitalist development. The technological

potential of GH2 for decarbonizing key economic sectors was already discussed in the 2000s and 2010s (see for example Staffell et al., 2019). In the late 2010s and specifically from 2020 onwards, GH2 became increasingly framed as an opportunity for green growth and a cornerstone of the energy transition strategies of powerful actors such as the US and the EU (Zhu & Wei, 2022). Key international organisations such as IRENA or the WTO have published policy recommendations based on highly ambitious demand projections: according to one paper, green hydrogen could supply up to 14% of the global energy mix by 2050, with up to 25% of the projected 500Mt in demand being traded internationally (IRENA & WTO, 2023). However, GH2 development is facing significant uncertainty influenced by several important structural conditions: the emerging market structure is characterized by an oligopsony; GH2 production requires extensive financial and technological capital; and states and multinational corporations from the Global North have a driving role.

Oligopsony:

First, many potential producers compete for only few potential centres of demand. Thus far, only the EU, South Korea and Japan have announced relevant levels of demand for imports in their hydrogen strategies (IRENA, 2024). Most other states either lack large-scale industries generating significant levels of hydrogen demand, or boast sufficient production potential themselves – as is the case for China or the US (Pepe et al., 2023). However, as green hydrogen can be produced nearly everywhere, many potential producers especially in the Global South, would need to compete for limited markets (IRENA, 2024). This creates a power imbalance in the markets, since "a few large buyers establish the rules and regulations for many potential exporters" (ibid., p. 21). This advantage further benefits the already privileged position of possible GH2 importers in the Global North. A representative of a hydrogen consultancy operating in Chile and the EU explained that such power over standard setting is a fundamental factor for shaping emerging GH2 value chains, since it influences early technology and project design choices (Interview 12).

Although all this creates an unfavourable playing field for potential exporters, building up GH2 production could also allow potential producers in the Global South to leapfrog industrial upgrading which is a key motivation for many of these states (Quitzow & Zabanova, 2024). This potential for attracting green industries however relies exclusively on the comparative advantage of abundant and cheap GH2 and renewable energies (Verpoort et al., 2024), which, given the high number of potential producers, will not be limited to a single state. All in all, this market structure creates the potential for a race-to-the-bottom among potential producers

(Müller et al., 2024), both in relation to GH2 production and GH2-based industrialization, likely aggravating local social and ecological consequences.

Control over Financial and Technological Capital:

Most potential exporters like Chile, Namibia or Marrocco strongly rely on transfers of financial and technological capital from the Global North and China. As of now, multinational corporations from these states dominate the production of the fundamental components and equipment necessary (i.e. solar panels, wind turbines, electrolysers, desalination plants) and are also leading technology development in these areas (Pepe et al., 2023). However, there are also some interesting differences: while China strongly dominates the production of alkaline electrolysers and the processing of necessary mineral inputs such as nickel, companies from the EU, UK and the US dominate the production of slightly more efficient, but less technologically mature PEM-electrolysers (ibid.). This has the potential to create conflicts over project design and value chain control. Given the early stage of technological development especially for industrial-scale electrolysers, there is also potential for innovative newcomers to establish themselves in this market (IRENA, 2022).

In addition to leading technologically, investors and multinational energy corporations from the Global North dominate the capacities for financial capital mobilization and risk-absorption necessary for the (initially) very expensive and risky GH2 projects (Interview 8, Interview 12). As demonstrated by Vezzoni (2024), the corporations driving hydrogen developments globally are either fossil energy corporations, or strongly related to the sector (e.g. grid operators, automotive industry). Their push towards developing a global hydrogen economy is motivated by diverse objectives including the diversification and greenwashing of operations, new opportunities to invest over-accumulated capital and/or the continuation of their business models. These companies have also established decisive organisational power through broad and global lobby organizations such as the Hydrogen Council. Thereby, these corporations significantly pushed a profit-based hydrogen agenda that strongly shaped hydrogen policies, especially in the EU (ibid., Balanyá et al., 2020).

Uncertainties and Challenges:

Despite the hype, global GH2 development continues to struggle with several key challenges such as limited competitiveness, high capital intensity, technological immaturity and sluggish demand. This creates uncertainties from all sides that have created a massive lack

between ambition and actual GH2 development (Odenweller & Ueckerdt, 2025). The representative of a hydrogen consultancy explains that:

> *"Banks wouldn't be able to provide loans to project developers because due to the high risk of these projects. There are no reference projects, the technologies are new, and the off-take is very uncertain. Everything is still under development, including the technologies, and the pipelines are only being built now. This means there are uncertainties from all sides, which makes the risk assessment for the banks very high—it's highly risky."* (Interview 12, Pos. 48-49)

Because of that, most banks only give out credits if companies have already been able to sign off-take agreements with buyers. However, such buyers are difficult to find, since GH2 is by far not competitive with a business-as-usual approach: "there's no off-take, as the price gap is three to four times more expensive than business-as-usual" (Interview 12, Pos. 127). In addition to directly subsidizing hydrogen prices, states could also drive prices of conventional products up, for example through carbon taxes (Interview 8), or introduce binding regulation for GH2 adoption in certain sectors, such as the FuelEU Maritime Regulation (EUC, n.d.). Market-based solutions in contrast focus on the scaling of projects and a subsequent reduction of electrolyser costs (Interview 11). However, electrolyser production as well needs to be expanded first, just as the pipelines and other infrastructure does not yet exist. Ultimately, it's a chicken-egg problem, which the private actor itself is unable to solve, as explained by a representative of an energy corporation:

> *„This is a matter of supply and demand. Why isn't green hydrogen competitive? Well, because the production of electrolyzers is still expensive. Why is the production of electrolyzers expensive? Because there isn't enough demand yet. Why isn't there enough demand? Because there are not enough projects. So, what's missing for there to be a project? For green hydrogen to be competitive. How do we make it competitive? Well, through pricing—gray and blue hydrogen are still more cost-effective. How do we do it? Well, let's find a way for governments to limit CO2 emissions. Which governments are supposed to do this? The United States, China, Australia, and Europe."* (Interview 8, Pos. 339-345)

Therefore, without active state intervention, the GH2 sector would not develop. Thus far, states have not pushed the industry enough, creating a gap between ambition and implementation, as analysed by Odenweller and Ueckerdt (2025). Without increased carbon taxes, "realizing all these projects would require global subsidies of US$1.3 trillion" (Odenweller & Ueckerdt, 2025, p. 110).

The Role of States and Public Investment:

Thus, if private actors are to develop hydrogen production and demand in the quantity and timeframe envisaged in policy documents, they would depend on states and international organizations to provide regulatory and fiscal incentives to facilitate off-take (Odenweller & Ueckerdt, 2025). Concrete examples are environmental deregulation, financial de-risking and/or subsidizes for production or take-off. So far, several powerful actors in the Global North as well as China have promised to pump large sums to boost hydrogen markets (Liebreich, 2023). This mobilization of public capital is embedded in a broader shift of fiscal and economic policies of major economies following the COVID-19 pandemic, especially in the US and the EU, away from austerity and towards a more active role of the state, embedded in the crisis of neoliberal, globalized accumulation and increased geopolitical competition (Brand et al., 2024; Quitzow & Zabanova, 2024). The more active role of the state is however mostly limited to coordinating the distribution of public funds to the private sector (mostly benefitting incumbent multinational corporations) with the goal to establish "green" industrial sectors and/or defend technological leadership (Quitzow & Zabanova, 2024).

Apart from direct subsidies, the most dominant public measures are financial de-risking schemes (e.g. beneficial credit lines) to drive GH2 supply, and contracts-for-difference schemes to accelerate demand growth (IRENA, 2024). For the former, the financial burden is increasingly shifted to potential exporters in the Global South, which has created some debate around possible debt traps and led scholars to argue for a more equitable burden-sharing (Gabor & Sylla, 2023; Haag et al., 2024; Odenweller & Ueckerdt, 2025). Contracts-for-difference schemes mostly exist in the Global North to boost domestic production and off-take by paying (a part of) the price difference between hydrogen (or derivatives) and conventional products. The EU, Germany and Japan have also created such schemes for foreign producers to promote GH2 supply, and through the specific design, they can influence key aspects such as the location, the social and ecological standards, the type of product or potentially even the equipment used (IRENA, 2024; Interview 12)

To conclude, global GH2 development is a key technological fix to ecological modernization strategies within a contested green-capitalist project that emerges along several preexisting structural asymmetries. It is shaped by broader green-capitalist developments and struggles, most notably the accelerated competition for control over 'green' technologies and the material inputs needed. Should global GH2 markets develop, many potential producers in the Global South would need to compete not only for limited external demand but also for financial and technological capital, which is concentrated in the Global North and China. This creates strong advantages for the latter to control value chains and technologies, shape production conditions and influence prices and profits. Most potential exporters however, which are already in a dependent position, must deal with unfavourable structural conditions. If possible producers fail to achieve GH2-based industrialization, colonial trade patterns in which peripheral states trade low-value added goods with industrialized goods from the core could be reinforced.

Thus, the observable structural conditions of GH2 development are characterized by highly asymmetrical power relations. In that context, the emergence of new or the reinforcement of existing dependencies is likely (Eder & Rammer, forthcoming), just as the intensification of ecologically unequal exchange and a possible race-to-the-bottom in terms of ecological or social standards among potential exporters (Müller et al., 2024). Despite these unfavourable structural conditions, the specific pathways and implications of GH2 development vary across individual cases and can are also shaped by different national contexts. Opportunities for emancipatory change and structural transformation also exist, and especially social movements have the potential to drive radical transformations (Temper et al., 2018). Ultimately, GH2 developments are contested, and thus defined by the outcomes of the struggles among various actors. Since the central arena for these struggles is the state, the following section investigates the specific national context of Chile.

4.2 Political-Economic Context in Chile

To establish the political-economic context of hydrogen development in Chile within a historical materialist framework requires paying attention to its historical emergence and the resulting path-dependencies and other structural limitations to agency (Wigger, 2025). Regulation theory proposes an overview of different historical phases of capitalism. For a comprehensive contextualization of the political-economic system in Chile, which is still within the scope of this thesis, the following analysis focuses on developments starting in the 1970s. Working through these historical developments is incremental for capturing the dominant

accumulation strategies, hegemonic powers and social relations within the state, contested society-nature relations and the specific embeddedness in international markets and institutions, that characterize the political-economic context in which hydrogen developments emerge today.

To that end, this sub-chapter starts with the period of neoliberal restructuring in Chile during the dictatorship of Augusto Pinochet (1973-1990) and its implications for the composition of the state, the accumulation regime and society-nature relations. The second section will focus on the stabilization and democratization of the neoliberal state and the commodity-based accumulation regime during the so-called Concertación-period, ending with bust of the commodity super cycle in 2012-2014. Lastly, the final section will focus on the developments between 2014 up until today. This section will cover the renewable energy boom in Chile and the emergence of a green-capitalist hegemony, the rise of ecological and social movements and the crisis of the neoliberal state culminating in the 2019 protests and the failed constitutional reform.

4.2.1 Neoliberal Restructuring and Commodity-Based Accumulation, 1970-1990

Up until the 70s, Chile experienced a period of state-led introverted industrialization which resulted in the establishment of some, albeit limited, industrial capacities (Jäger & Leubolt, 2014). In the early 70s, a brief period of socialism implemented by democratically elected President Salvador Allende was abruptly interrupted by a CIA-orchestrated military coup that brought dictator Augusto Pinochet to power (Taylor, 2002). In the following period, Chile was restructured along neoliberal principles in an alliance of the regime with parts of the business elite, ideologically following the so-called Chicago boys, a loose group of economists influenced by Milton Friedman's teachings in Chicago (Tecklin et al., 2011). State companies were rigorously privatized, civil society organizations and labour unions suppressed. The neoliberal free-market ideology was enshrined in the country's constitution of 1980 with the concept of the subsidiary state, limiting the state's role to a facilitator of accumulation (DeStephano et al., 2022).

The decisive shift in power away from the working class and its formerly strong popular unions towards capitalist elites was enforced through violent suppression that involved "summary executions, torture, rapes, disappearances" (Nef, 2003, p. 24). Pinochet's brutally imposed privatization and free trade regime, together with the dismantling of the state apparatus and social welfare, led to "massive unemployment, hunger, homelessness, and a drastic

reduction in the standard of living" (Bresnahan, 2003, p. 4), especially for the working class. The public sector was effectively sold-out to national conglomerates close to the military and transnational corporations with little accountability (Nef, 2003, p. 20). Domestic conglomerates and transnational corporations not only gained political control but also expanded their power over the economy, profiting from privileged access to former state asset (Bril-Mascarenhas & Madariaga, 2019).

After Pinochet's reforms resulted in de-industrialization a failed period of financialization, the importance of extraverted commodity-based accumulation grew and expanded to new export sectors emerged, such as salmon of forestry industry (Castaño et al., 2019; Jäger & Leubolt, 2014; Lebdioui, 2019). Diversification of the overall economy was thus limited to a basket of primary goods for exports (Bril-Mascarenhas & Madariaga, 2019) that was strongly dominated by copper (Jäger & Leubolt, 2014). Despite the diversification tendencies, dependency on copper exports remains a fundamental characteristic of Chilean political economy until today: "Today, as a country, we are highly dependent on the price of copper – when copper prices rise, the country becomes wealthier; when they fall, the country becomes poorer" (Interview 11, Pos. 183–184).

The expansion of extraverted, commodity-based accumulation regime was driven by domestic and international business elites and facilitated by the neoliberal constitution's prioritization of private property enforced through a brutal executive (Bril-Mascarenhas & Madariaga, 2019). This also resulted in an expansion and consolidation of extractivist society-nature relations, underpinned by processes of territorialization[6] and the commodification of nature and dependent on the marginalization and precarization of local communities (Interview 5, Interview 7). For example, the expansion of agrobusinesses was achieved through capital intensive modernization and technification that allowed for a further intensification of resource extraction (Nef, 2003). It resulted in the emergence of rural capitalist elites facilitated by the dispossession and impoverishment of former small landowners, whose cheap labour stabilized the accumulation regime (ibid.). Similarly, indigenous communities throughout Chile suffered from violent dispossession and marginalization, especially due to the expansion of forestry (Mora-Motta, 2024).

[6] Territorialization is a concept from political ecology that describes the processes that constitute and regulate territory and the underlying, spatially-specific reconfiguration of society-nature regimes. This can encompass discourses, coercion or other activities that affect the control, management and access to natural ecosystems and their resources (Bassett & Gautier, 2014)

4.2.2 Concertación and Neoliberal Consolidation, 1990-2010

The end of Pinochet's regime and the return to democracy in 1990 brought four successive Concertación-coalitions comprised of nearly all democratic parties, which promised a political change through (re-)democratization. The transition to democracy was shaped by high-level negotiations between the military, capitalist elites and the leaders of the Concertación and resulted in the consolidation of extraverted commodity-based accumulation within a neoliberal state (Bresnahan, 2003). This was facilitated by a "deliberate strategy of demobilizing the organized popular sectors and maintaining a politics of accords negotiated at the top" (ibid., p. 6). In contrast, capitalist elites were able to expand their grip over the political-economic system during the following decade. As argued by Jorge Nef (2003):

> *"Their size, financing, organization, interlocking capacity, representation in official government agencies, control over the media, internationalization, and ability to determine the intellectual agendas of universities have made them, for the first time in Chilean history, a hegemonic business class stronger than the state."* (Nef, 2003, p. 22)

This is a strong example of passive revolution, where political transformations are implemented through a top-down process that include limited compromises to maintain and consolidate the overall power structure under social pressure. According to Brand and Wissen (2015), this is achieved "either by the co-optation or conversion of key political personalities or groups belonging to the leadership of the subordinated class; and/or by the marginalization of the forces which deliberately resist the dominant development or oppose them for other reasons" (p. 520).

While business elites expanded their political control, the neoliberal state was further weakened through de-politicization and increasingly technocratic decision making (DeStephano, 2022). Rafael Agacino (2003) thus describes the Concertación was just as the "civil administration of a mature counterrevolution" (p. 41). Starting in the Concertación period, the programs and ideology of parties to the left and right converged more and more, contributing to a crisis in voter representation and growing disillusionment with the main parties (Madariaga & Kaltwasser, 2020).

The transition to democracy also continued and deepened commodity-based accumulation regime, further consolidating the pattern of massive wealth and income inequalities (Agacino, 2003). Most remaining public sectors, such as railways and energy provision, were privatized

and opened to international investors (Fischer, 2011). Commodity-based accumulation expanded during and beyond the 1990s, facilitated by a boom in commodity prices between 2003 and 2013/14, the so-called commodity super cycle (Brand et al., 2016). The commodity sector became increasingly internationalized through mergers with or acquisitions by foreign investors, most notably, transnational corporations (Fischer, 2011). Chilean conglomerates maintained their powerful position, and in 2007, the three largest conglomerates "Angelini, Matte, and Luksic – equalled 15 per cent of the Chilean GDP" (Bril-Mascarenhas & and Madariaga, 2019, p. 1056). In contrast to other states in the region, higher rents due to growth in commodity prices were not distributed to the broader population, e.g. through welfare programs. Rather, a massive outflow of profits from Chile occurred (Jäger & Leubolt, 2014).

The developments between 1990 and 2010 saw a further internationalization of the Chilean state and economy, manifested in the increasing importance of external demand, the growing importance of foreign capitalist groups and the expansion of free-trade networks. Thus, in 2011 Chile was "among the most open economies in the world" (Fischer, 2011, p. 148) However, the strong outward orientation and reliance on commodity exports led to substantial consequences following the bust of the commodity super-cycle. GDP growth slowed significantly and private investment, both domestic and foreign, vanished almost entirely (Eyraud, 2015). Unemployment also rose sharply, especially among the youth (Rodríguez-Puello et al., 2022). This is a key pattern in Chile's economic development over the last 50 years: booming commodity prices (especially copper) spur investment, expansion and growth, while busts result in economic turmoil (Solimano & Calderón Guajardo, 2017).

4.2.3 Environmental Regulation of Extractivism, 2010-2019

The continued expansion of the extraverted, resource-based accumulation regime in Chile also reached beyond its ecological limits. A particularly severe case was the 2008 outbreak of infectious diseases in salmon industry (Asche et al., 2009). Following international pressure, most notably from the OECD, first substantial improvements in environmental regulation were implemented, but was still "subject to the imperative of economic growth" (Madariaga, 2019, p. 455). The lack of regulation contributed to increasing opposition against extractivist society-nature relations. A critical juncture in this regard are the protests against hydropower expansion into the southern Aysén region. The largescale projects were a response to the growing energy demand, driven to a significant extent by expanding extractive industries (DeStephano et al., 2022).

In the early 2010s, indigenous communities and environmental movements spearheaded what would become broad civil opposition against these plans (Allain & Madariaga, 2020). The increasing social pressure for environmental protection was not only an expression of growing awareness of the ecological crisis but also a response to and rejection of an enormously unequal and destructive commodity-based accumulation regime (Borgias & Braun, 2017). The rowing environmental movement was able to build unlikely alliances with academic, political and even business actors and push for stricter environmental regulation (Madariaga & Allain, 2020). Although the reforms were strongly watered down by counter-initiatives of dominant elites, stricter environmental regulation was achieved.

Still, neoliberal hegemony, implemented through the technocratisation of policy-making, continued to penetrate the political system (Flores-Fernández, 2020). This was underpinned by networks of neoliberal thinktanks that also had strong international ties (Fischer & Plehwe, 2017). These networks were sponsored by the capitalist elites, which had also expanded their strong organizational capacities through the establishment of influential business associations such as the 'Consejo Minero' for mining or the multi-sector business association CPC. Furthermore, capitalist elites had long established close ties with both the left and right coalitions, also through both legal and illegal financing. Big businesses further sponsor a range of neoliberal think-tanks and influence public debate with regular pro-business publications in major newspapers (Bril-Mascarenhas & Madariaga, 2019). Political initiatives that sought to expand the role of the state in the regulation of capitalist accumulation were actively obstructed and watered down to uselessness by the powerful political and ideological influence of the internationalized capitalist elites' (ibid.). Thus, despite the crises of the resource-based accumulation regime in 2008/9 and 2013/14 and increasing civil discontent, neoliberal hegemony remained dominant, and the state's relative autonomy severely limited vis-à-vis the interests of capitalist elites.

4.2.4 Estallido Social and Failed Constitutional Reform 2019-2022

Nevertheless, growing environmental opposition shifted the power relations within the Chilean state, increasing tensions that finally erupted in the massive social protests in 2019, the so-called 'Estallido Social' or 'social explosion'. Protests started on October 14th, 2019 in Santiago, initiated by students opposing the increase in metro fares, and by the end of the week, massive protests had spread throughout the country. The protests expressed the massive civil discontent with the capture of the state and economy by capitalist elites and its implications – the worsening social inequalities and ecological destruction. Thus, protestors demanded

transformational change to overcome this neoliberal, elitest model and the structural inequalities it had created, focusing on the reform of the neoliberal constitution (Gordon-Zolov, 2023). Although a pact among the political elite in November 2019 paved the way for a constitutional reform, protests continued into the COVID-19 pandemic but eventually died down.

Elections in November 2021 resulted in the victory of a centre-left alliance led by Gabriel Boric (Cambero, 2021). This also influenced the work of the constitutional convention which however had already begun drafting a new constitution during summer. However, the proposal for a constitutional reform was rejected in a referendum in 2022, despite a plural and decentralized drafting process and a draft that directly engaged with key criticisms of Pinochet's 1980 constitution (Larrain et al., 2023). For example, the draft included measures for "expanding social rights, decentralizing power, strengthening legislative majorities, fostering pluralism and social inclusion, and allowing direct citizen participation in collective decision-making." (ibid., p. 234). The draft also included more controversial demands such as the introduction of a plurinational judicial system to account for more indigenous self-determination, more rights for labour unions and less rigorous protection of private property (ibid.). Furthermore, the draft was explicitly aiming to transform society-nature relations by giving fundamental rights to nature that might even trump other key rights (e.g. the right to private property) and committing governments to environmental protection (Huneeus, 2022).

Despite high initial support, the constitution failed due to a mix of reasons, and explanations vary strongly. The absence of right-wing representatives in the convention certainly contributed to the strongly progressive outcome (Larrain et al., 2023). Furthermore, media, in control by capitalist elites, promoted conservative and right wing positions (Vergara, 2021). This is in line with arguments emphasizing powerful misinformation campaigns business elites and politicians of the (far) right (Piscopo & Siavelis, 2023). As such, the defeat of the draft was the outcome of an intense struggle between subordinated forces striving for emancipatory transformation and dominated forces interested in retaining their neoliberal hegemony domination over the political-economic system. The defeat strongly altered social power relations in the country to the benefit of the business elites and the political right. Beyond the state apparatus, the influence of civil society organizations and indigenous communities suffered a major setback. To conclude, the long-standing social-ecological grievances exploded in the 2019 Estallido Social, but the demands for structural change were again constrained and obstructed by capitalist elites operating a commodity-based accumulation regime.

4.3 Renewable Energy Boom and Green Capitalism in Chile

In addition to the broader historical evolution of Chilean capitalist society, GH2 development is strongly shaped by developments in the Chilean energy sector. During the Pinochet-dictatorship, the ownership and management of energy systems in Chile was turned over to private actors and since then, the role of the state in the energy sector was almost non-existent (Furnaro, 2020; Madariaga & Allain, 2020) This resulted in a highly concentrated market: in the early 2000s, three companies (Endesa, today Enel Chile, Colbún, and Gener, today AES Andes) controlled about 90% of the total electricity market and relied heavily on fossil energy and hydropower (Madariaga, 2019). Furthermore, these companies were closely linked to high-level political institutions, through donations or even personally – the minister of economy in the early 2000s was a former AES Andes executive (Madariaga & Allain, 2020). Starting in 2013/14, the country experienced a massive renewable energy boom that was driven almost exclusively by private investments and turned Chile into a frontrunner of green-capitalist accumulation (Madariaga, 2019). Following the policy reforms detailed in chapter 4.3.1, new solar and wind energy projects entered the market, and with them new players. Although their control over the energy market had reduced, the dominant energy companies remain the dominant players in the energy sector until today (Allain & Madariaga, 2020; Madariaga, 2019; Madariaga & Allain, 2020).

4.3.1 Contested Energy Reforms

The reforms in 2014-2018 were the outcome of a policy struggle strongly shaped by growing energy demands, civil society opposition, and international embeddedness. In 2010, the dominant strategy for addressing growing energy demand focused on large-scale coal and hydropower projects and the exploration of nuclear energy and was promoted by political and capitalist elites (Allain & Madariaga, 2020). However, broad public opposition to these plans constrained the options for feasible energy projects significantly (Madariaga, 2019). This slowed investments in new projects, while energy demand was growing rapidly (Furnaro, 2020). Increasing demand was related to the expansion of extractive sectors, above all copper mining, which in 2015 consumed 34% of all electricity produced in Chile. Mining was not only the principal responsible for growing demand, but due to its high energy consumption, would also be the primary victim of rising energy prices which constitute the bulk of the expenditures in the sector (ibid.). Together with the bust of the commodity super-cycle in 2013/14, an energy crisis would have severely affected if not (temporarily) crashed the whole industry.

Furthermore, the bust of the super-cycle resulted in a collapse of FDI inflows to Chile, which are central to the country's strongly extraverted accumulation regime (OECD, 2023). Thus, the reforms removed market entry barriers to boost investments in new areas. This has proven highly successful: between 2012 and 2021, the share of FDI in the energy sector grew from 8% to 15% while the share of FDI in mining reduced from 34% to 28%. The limited reduction of the mining sector despite the collapse following the bust of the commodity super-cycle can be explained by a rebound in copper FDI by about 2014 and growing investments in the lithium sector (Barandiarán, 2019; Bonnet, 2025; OECD, 2023). The strong increase in FDI into the energy sector was driven primarily by renewable energy projects and dominated by European companies (OECD, 2023), especially from Spain and France (Furnaro, 2020). As such, in addition to "mobilize investments and capital flows in Chile's stagnated economy, and to address the state's legitimation crisis in the environmental arena" the renewable energy boom was also a "spatial fix for the circulation of overaccumulated national and international capital" (ibid., p. 969). Lastly, attention must also be paid to the involvement German agency for development cooperation, the GIZ. In 2012, the agency started to cooperate with the Chilean Ministry of Energy with the objective to support Chile's energy transition along a green-capitalist pathway, and provided studies, expert knowledge and policy recommendations that were later reflected in the reforms (Interview 13).

Ultimately, despite the fundamental role of civil society in driving these reforms, they maintained a strong neoliberal character that centred on the driving role of private actors, so that questions relating to the type of project, the location or the use of the energy was basically left for investors to decide (Furnaro, 2020). Due to the absence of state intervention, economic linkages such as the production of (parts for) wind turbines or solar panels did not materialize, despite earlier promises. As explained by a researcher from the University of Chile, "the development of renewable energy in Chile so far, the last 10 years, which has been very strong, is done with a lot of imports. The technology is not produced here, nor it is designed here, everything is imported." (Interview 10, Pos. 117-118). Similarly, Furnaro (2020) concludes that Bachelet's reforms further "reinforced the neoliberalisation of energy governance" (p. 970) . According to environmental and social organizations, participation surrounding the reforms was "insufficient and instrumental", and consultations were designed as "deliberative methods based on consensus-making"(Allain & Madariaga, 2020, p. 688). The consequence was that the reforms ultimately favoured the interests of business actors in maintaining the overall status-quo over the more radical demands voiced by civil society.

Instead of challenging the accumulation regime, renewable energy expansion stabilized it by reducing energy prices. Also, with new business actors operating in the markets, they contributed to a further atomization of labour unions, so that today the energy sector "is very little unionized, very outsourced, a lot of unregulated subcontracting and atomization, that is, there are many small unions that have a small local negotiations" (Interview 2, Pos. 6) The reforms furthermore perpetuated extractivist social-nature relations and also opened up new spaces for capital accumulation and "green" growth, e.g. by facilitating the expansion of "green" energy projects to indigenous territories in southern Chile (DeStephano et al., 2022; Furnaro, 2020; Sanchez De Jaegher, 2018). Ultimately, the reforms promoting renewable energy, i.e. ecological modernization, allowed the Chilean state to stabilize both the crisis of commodity-based accumulation and the ecological crisis by transitioning towards a green-capitalist mode of development.

4.3.2 Passive Revolution and Green-Capitalist Hegemony

As argued by Brand and Wissen (2015) and Wanner (2015), Gramsci's concept of the passive revolution, according to which the resolution of crises is achieved through the limited incorporation of demands and/or dissenting representatives so not to challenge capitalist accumulation and its underpinning power relations. This was clearly the case during the energy policy reforms in Chile. Social opposition to the neoliberal, commodity-based accumulation regime was dispersed in a similar way like in 1990, following the transition to democracy, or in 2021 with the Boric government. Opposition was effectively regulated by marginalizing radically dissenting actors while incorporating moderate actors and their demands into a highly technocratic state apparatus dominated by a neoliberal discourse

Incorporation forced these actors to act within the constraints set by the political status quo, a strategic terrain dominated by the interests of corporate elites. Within this context, the only option to influence decisions was through compromises with the prevailing system. The outcome was a neoliberal renewable energy expansion with little state coordination or oversight (Furnaro, 2020), that subsequently became the basis for a hegemonial project along the lines of green capitalism supported by almost the entire political elite. According to an expert from an energy consultancy, "it is generally the case in Chile transversally in the energy sector (…) that even if it's always left-right government which always take turns, [policies] in the energy sector have always been fairly constant" (Interview 12, Pos. 112). Instead of structural transformation, the broad contestations thereby ultimately contributed to the emergence and subsequent consolidation of a green-capitalist hegemony in Chile.

Thereby, the post-2014 renewable energy expansion laid the basis for a green-capitalist project led by the Chilean political and capitalist elites that was consolidated in the following years. This was facilitated by the weakening of emancipatory civil society actors following the Estallido Social and the subsequent failed constitutional reform. Promoting green growth was a central aspect of the Piñera governments recovery plan after the pandemic and about a third of the additional public recovery was dedicated to 'green' projects, which received applause by the World Bank (Bucher & Winter, 2020). Similarly, the Boric government adopted a business-friendly strategy that promotes the decarbonization and diversification of extractive sectors based on a rapid expansion of renewable energy as a viable development path (Arias-Loyola et al., 2025).

Building on green growth narratives, the Boric government has pushed those extractive sectors that are framed as fundamental for the global transition to a 'green' economy, above all lithium, copper and hydrogen (Carrasco & Madariaga, 2022). This is embedded in global institutions that promote the decarbonization consensus and the related appropriation of 'critical' minerals and natural resources from the Global South. For example, in its 2024 Economic Outlook, the OECD recommends Chile to further de-regulate, arguing that "continued reforms to streamline regulatory processes are crucial to spur entrepreneurship and attract investment, particularly in sectors connected to the green transition" (OECD, 2024, p. 123)

Alongside the narrative of greening extractivism, political elites also addressed socio-economic discontent by promoting green industrialization narratives and a stronger regulatory role of the state. A striking example is the interrelated expansion of renewable energies and lithium, which materialized in about the same timeframe (Barandiarán, 2019). According to Chilean officials, building up lithium-based storage technologies would allow the country to not only climb up the lithium value chain but also store and possibly export its rich renewable energy potential. Analysing debates and policies in Chile, Barandiarán (2019) argues that these narratives ultimately aim to reimagine "the relationship between mining and development in which lithium, through innovation and industry, will redefine the relationship between Latin American economies and global markets" (p. 381).

Policy initiatives that sought to expand state control achieved limited success and received strong international backlash (Carrasco, 2024). In addition, there are several challenges to industrial upgrading in Chile that include its small market size, geographical isolation and international competition, which makes it unlikely that investors would choose Chile as a

location for industrial production (Interview 1, Interview 8). These are also central explanations for the lack of industrial upgrading during the massive renewable energy boom, according to a business actor. “Why didn’t we bring the wind turbine or panel manufacturers to Chile? (…) Because the local industry is very small. I mean, there’s no steel production, there’s a lot of production missing, but also, it’s not a relevant market” (Interview 8, Pos. 178-184).

Furthermore, the OECD points out that the potential of upgrading Chile’s economy towards high-tech industries with more value added is hindered by the lack of “a strong policy framework for innovation/research, development, and human capital development” (OECD, 2023, p. 42). Even though the state takes on a more active role in order to drive industrial upgrading and increase value capture in lithium production, these constraints are very difficult to overcome. Thus, “even the region's most progressive lithium policies remain constrained by global market forces, neoextractive dynamics, and green growth imperatives, perpetuating long-standing inequities” (Carrasco, 2025, p. 11).

This points at several conflicts and contradictions within the hegemonic green-capitalist formation in Chile. First, in opposition to the interests of the private sector, the state seeks to expand its role in the green-capitalist mode of development and further stabilize commodity-based accumulation by increasing socio-economic benefits through improved value capture. Second, and relatedly, both green industrialization and green extractivism are strategies that seek to stabilize the commodity-based accumulation regime by addressing its ecological and socio-economical injustices or at least justifying them in reference to their supposed role in solving the climate crisis. Ultimately, these strategies expand and deepen extractivist society-nature relations and further aggravate the ecological crisis and the related social and ecological injustices. Third, these strategies evolve within global capitalism’s asymmetric power relations and are highly dependent on global market mechanisms that perpetuate the very dynamics that they seek to overcome. These considerations are of key relevance for Chile’s massive new green-capitalist project: the development of a green hydrogen economy.

4.4 GH2: A Green-Capitalist Prestige Project in Chile

The debate surrounding GH2 development in Chile emerged in parallel to developments at the international level. Debates intensified with the publication of the National Green Hydrogen Strategy in 2020 by the Piñera government that outlined the key objectives and motivations for GH2 development in Chile. In the document, GH2 development is framed along three key narratives: as an opportunity for green growth, as a key technology for the country’s domestic

energy transition, and as a pathway towards becoming a leader in the global energy transition (Government of Chile, 2020). The 2020 strategy promoted export-oriented GH2 development and highlighted the potential to green other commodity-exporting sectors, especially mining, following along the lines of the dominant green-extractivist logic. With that, the government posited GH2 development firmly within the broader green-capitalist hegemony. The stark economic recession due to the COVID-19 crises and the related collapse of FDI inflows (OECD, 2023) likely also contributed to the corporate-focused design and overly ambitious character of this strategy. While this overall direction remained largely unchanged, the 2024 Green Hydrogen Action Plan by the Boric government featured more references to green industrialization, including measures to attract electrolyser capacities to Chile (Government of Chile, 2024), which indicates a certain degree of policy conflict. Before investigating this conflict in more detail, the following section will outline some general contextual factors that inform, enable and constrain GH2 developments in Chile.

4.4.1 Limitations in State Capacities and Relative Autonomy

First, Chile's limited state capacities and the neoliberal hegemony within political and economic elites strongly constrain the state's options in designing and regulating hydrogen development. As elaborated in the previous sections, the Chilean state apparatus is particularly weak, and commands limited relative autonomy especially vis a vis domestic and international capitalist elites. This is further aggravated by the constitutional specification limiting the state's role in economic affairs to facilitate a free market (Interview 10, 132-133). This concept of the subsidiary state is central to the neoliberal economic regulation hegemonic among the political and capitalist elites (Bril-Mascarenhas & and Madariaga, 2019). In addition, capitalist elites are closely entangled with political elites and policymakers.

Thus, the strategic selectivity of the state is strongly skewed towards the interests of business actors, especially the dominant large conglomerates and multinational corporations. This has been evident in the recent policy struggles in which ultimately, the interests of business actors prevailed over emancipatory interests of civil society actors. This is further enabled by the prevalence of high-level corruption and a lack of enforcement, which has been particularly evident in the (cooper) mining industry where companies have basically just ignored or bypassed laws (Carrasco & Madariaga, 2022). Critical researchers therefore strongly doubt the state's ability for implementing and enforcing efficient regulation against the interests of business actors (ibid.).

Furthermore, the state's limited regulatory capacities severely limit the ability of CORFO in driving productive development, establishing economic linkages and promoting GH2-based green industrialization is severely constrained. Unsurprisingly, an interventionist regulatory approach aimed at increasing positive externalities (e.g. by implementing sourcing requirements) or limiting negative implications (e.g. by enforcing stricter social and environmental impact regulation) is thus far largely absent in the key policy documents mentioned above. A representative of CORFO Magallanes explained that to what extent companies create positive externalities or other benefits for local communities is "all voluntary. There is no obligation." (Interview 6, Pos. 186). Indeed, agreements exist between the state and big GH2 investors, such as the Pacto Magallanes for the Southern region, that include commitments to local sourcing of equipment and labour, but they as well are fully voluntary (Interview 6). This creates a situation in which it is unclear whether the companies will even contribute to regional decarbonization, as explained by the representative:

> "*So we are already addressing that, but from the beginning they always said that this is not my business, my company is going to have a closed energy circuit, it is going to need a lot of energy. All those conversations have been changing, they have been mutating, and we are getting closer and closer to the possibility of having wind energy [for the region]. Because basically I told them: if we are going to have this massive industry, the least we should aspire to is to make a carbon neutral region, the absolute minimum (Interview 6, Pos. 74)."*

Given that today, the region relies almost 100% on natural gas for electricity and other energy needs (Interview 6), discontent within the population would be guaranteed.

In addition, the state also is limited in its capacities to provide incentives (e.g. subsidies) or even efficiently coordinate (e.g. through ex-ante spatial planning). Given the ample uncertainties, high prices and limited profits, subsidies in various forms play a key role for enabling GH2 industries (Odenweller & Ueckerdt, 2025). However, in contrast to the US or the EU, which have both implemented broad subsidies and contracts-for-difference schemes, Chile clearly lacks the budget for such programs (Interview 8). The lack of capacities even extends to efficient coordination, which could reduce uncertainties and knowledge gaps for investors. According to the representative of a consultancy that works closely with the government, the staff working in the ministries and the overall state apparatus sometimes lacks the expertise or

experience, especially in the new Boric government. However, the main issue is that the staff is chronically understaffed and overworked:

> *"There is a lot of talk, but there is a lack of implementation, and I think an important point is really that the people who are in the ministry today are completely overworked and somehow do five things at once"* (Interview 12, Pos. 118).

The same is the case for the regional agencies of CORFO or the SEA in Magallanes (Interview 6, Pos. 516; Interview 4, Pos. 22), which strongly hinders the state's ability to coordinate GH2 development.

4.4.2 Extraverted, Commodity-Based Accumulation Regime

Second, Chile's economic profile, dominated by an extraverted, commodity-based accumulation regime, determines several important drivers and limitations for GH2 development. The centrality of extractive sectors in Chile's economy means that relevant domestic demand for GH2 comes from these sectors. The transports necessary for exporting the products (e.g. trucks, ships) also play an important role as potential local off-takers (Interview 11, Pos. 50-68). However, the mining industry has so far not shown a lot of interest in hydrogen, as of now, most actors prefer direct electrification (ibid.). Nevertheless, business actors, government officials and a representative of GIZ have expressed confidence that demand from these industries will ultimately materialize, given their need to decarbonize. The representative of GIZ, for example, highlights the potential of "greening" copper mining, fully in line with a green extractivist discourse (Interview 13). Similarly, the 2020 National Green Hydrogen Strategy emphasizes that "A concrete opportunity [for local use of GH2], for example, would be to become the world's leading producer of green copper." (Government of Chile, 2020, p.5).

Apart from extractive sectors, the country's economy is comparatively small and lacks any significant industrial capacities (Interview 8). This situation is further complicated by Chile's geographical isolation, which presents a barrier for companies seeking to relocate. Thus, current local demand is basically non-existent and potential future demand will be limited. In light of this, the state had to change its approach: in the 2020 strategy, it was stated that local demand would potentiate the industry to be competitive at international markets (Government of Chile, 2020). In 2024, government officials argued the other way around – that export-oriented projects would reduce prices to make local off-take attractive (Interview 11). However, the absence of local demand adds to the challenges faced by private actors as well as the state. For

GH2 producers, it increases risks, since the absence of local demand prevents diversification and deepens the dependence on international markets for hydrogen (Interview 12), which however will be highly limited: "there will be many suppliers, and we have to make sure that we are extremely competitive and therefore among the top players" (Interview 1, Pos. 193-194). Furthermore, the dependence on international demand exacerbates vulnerabilities related to price volatility or demand shortfalls.

Despite these issues, Chile's economic openness offers several important advantages for international investors: its extraordinary network of free trade agreements benefits export-oriented production and is supplemented by strong investment protections and an overall ease of doing business for international capital (Interview 9). This is of key importance for Chile's hydrogen strategy, as it depends strongly on international capital and technologies. When asked for the significance of FDI for GH2 development, a government official answered:

> *"Super important. I believe that, at least from what I've seen, without foreign investment, the development of the green hydrogen industry is very difficult. So, in essence, it is vital. They are essential actors for development, and technology transfers as well, absolutely."* (Interview 9, Pos. 108-116)

Thus, in addition to its dependence on international demand, Chile also relies on inflows of international financial and technological capital. In the context of strong international competition and a potential race to the bottom, this reliance constraints the state's opportunities to adopt and enforce regulation that goes against business interests. Combined with the absence of local demand, the of domestic industrial capacities and of local sourcing requirements, the opportunities for economic linkages and marked-based green industrialization are strongly reduced. In this context, business actors have demonstrated scepticism of the governments' limited measures to drive industrialization and would instead favour measures designed to de-risk production projects (Interview 8). This scepticism of Chile's potential to achieve GH2-based, corporate-driven industrialization supported by limited state intervention is shared in early investigations by various researchers, such as Eder and Rammer (forthcoming), Scholvin (2023), or Scholvin and Kalvelage (2025).

4.4.3 Extractivist Society-Nature Relations

Third, extractivist society-nature relations and neoliberal hegemony strongly shape GH2 development. At the regional level, the territories of the two main areas attracting GH2 projects, Magallanes and Antofagasta, are significantly shaped by extractive society-nature relations. In

northern Antofagasta, this is particularly evident, due to the long history of extractive industries such as copper and lithium in the region. These industries not only dominate the regional economy, but have also taken on important social roles, e.g. in providing key services such as health care, due to the lack of state presence (Furnaro, 2020). Extractivist society-nature relations have materialized in the regions' infrastructure and are enshrined in the social fabric. This context creates a favourable environment that attracts large-scale, export-oriented GH2 production, as explained by a business representative:

> *"In the north you have many transmission lines, in the north you have many roads, that is, you have roads for everything, you have port infrastructure. (...) Of course, the north, let's say, is more accustomed to having industrialists close to it. (...) And the industrialists are more used to deal with these communities. I mean, there is mining, there is energy, there are chemical plants, there are gas plants. There are a number of relevant industries. In the northern zone people already know what to ask, what not to ask, where to ask, how to negotiate."* (Interview 8, Pos. 104-109)

In Magallanes, the context is slightly different. On the one hand, as already noted, the region also looks back to a long presence of extractive industries, especially salmon farming and gas extraction, but at a much smaller scale (Interview 7). Still, this has shaped society-nature relations in the region, with catastrophic impacts on maritime ecosystems and the disintegration of local communities due to companies' strategies that aim to pit neighbours against each other (Interview 5). On the other hand, Magallanes is the southern-most region of Chilean Patagonia, which today holds the image of pristine wilderness that needs to be conserved, an image that was socially constructed from the 90s onwards (Núñez et al., 2022).

In that process, nature was constructed as something to be conserved, replacing the earlier representation of the region as empty land with resources that wait to be exploited and challenging the overall extractivist society-nature relations of the commodity-based accumulation regime. This development however also resulted in new valorisation processes and the inflow new investors searching to profit from the conservation and preservation of nature (ibid.). As argued by Mendoza et al. (2017), "a regional imaginary has emerged around transnational regimes of representational value pertaining to tourism, the outdoor industry, and environmentalism. (…) [An image of] Southern Andean Patagonia as a space committed to green development." (p. 95). This obviously contradicts large-scale industrial development and

creates decisive potential for conflicts between conservationist and extractivist logics and the actors supporting them.

The Magallan plains however differ from Patagonia's typical representation and are instead mainly characterized by wide steps with few trees far in between, bent by the constantly strong winds. This image fits well with the narrative of the empty land waiting to be developed which had been dominant during colonization and beyond (González et al., 2014), a narrative that today is frequently reproduced in discourses surrounding hydrogen development (Interview 1). Such discourses obscure the region's rich unique and highly delicate ecosystems and its rich history of indigenous settlement.

This context results in very specific social and ecological risks the challenge the environmental evaluation of GH2 projects. As explained by a representative of the responsible state agency SEA, GH2 production "is a new category of projects that we are talking about, in which we do not know how these mega wind farms are going to relate [to the environment]" (Interview 4, Pos. 25). The massive extension of the industry aggravates the potential ecological implications, and the SEA is particularly worried about the impacts on birds and maritime ecosystems. For the latter, the potential impacts are related to the construction and operation of new ports and desalination plants (Interview 4). Desalination is necessary because the region is plagued by droughts and water scarcity. The related impacts are primarily linked to the handling of the residual brine. While some projects in the region claim to re-use the salt, projects like that by HNH Energy plan to discharge it into the sea. This could cause problems:

> *"The Strait of Magellan has some singularities or important environmental sensitivities in terms of the presence in the habitats of young whales, of the Chilean dolphin, and of the southern right whale. These are species that are sensitive, so we are very concerned about evaluating the impact that will occur."* (Interview 4, Pos. 78)

According to the SEA representative, the large number of projects and their massive territorial occupation could further aggravate such impacts. However, an ex-ante study that investigates the combined potential social and ecological implications of the announced GH2 projects has never been carried out. Such a study is also not within the SEA's competencies – only the evaluation of combined effects if two or more projects are to be constructed in proximity to each other (Interview 4). Aggravated impacts are also a major concern when it comes to avian fauna:

> *"Precisely the places where the green hydrogen industry is planned to be installed, are places where there are migratory routes [of birds]. And we have here (...) an endangered species, with very few individuals, and there is also a lot of concern that this will give the final blow to the species."* (Interview 4, Pos. 58)

Industry representatives highlight that they take these concerns seriously and have ordered radars to detect birds approaching the wind farms to then turn off those wind turbines on the bird's route (Interview 1). However, project developers also concede that impacts are inevitable with an industry at that scale. Ultimately, people need to decide between development or preservation, according to one investor:

> *"So I always say that we want to increase our prosperity and are not prepared to make certain concessions. (...) I say that to everyone I meet in the population. Birds will die and if we are not prepared to accept that, then we have to say, better not. I also say: but ladies and gentlemen, there's a huge hotel over there with a glass façade. Don't tell me that no birds are dying there."* (Interview 1, Pos. 94-95)

This statement shows that contestations surrounding the transformation of society-nature relations are predestined.

In the emerging conflicts, indigenous communities also play a central role. In the early 20th century, colonizers brutally murdered and displaced most indigenous peoples to such an extent that only few have survived (Interview 7). The specific history has also resulted in different levels of visibility and power of indigenous communities when compared to Antofagasta. As explained by an indigenous community leader in Magallanes:

> *"In the north, the indigenous organization has much more influence on certain things than here in the south. Indigenous communities manage their national parks; I don't know, that's unthinkable here. There is a strong presence of them, how they negotiate, what they really get is another question, but they are a very lively, very present community with established power. I think that's also part of how they succeeded in that area. (...) [But here in Magallanes] the thing is that there are few indigenous communities still living in the territory, due to the genocide in this area. In the Magallanes region, they basically killed almost all the descendants of the Huelche, which was*

> *incredibly devastating. It's a region that has been extractivist since its beginnings. So, yes, there are few representatives of communities"* (Interview 7, Pos. 174-186)

Despite these challenges, the remaining communities strongly oppose this social and political marginalization and are heavily involved in local struggles against extractive industries like salmon. Now, parts of the communities mobilize against hydrogen, to defend ancestral burying sites and maritime ecosystems that are sacred to these communities.

4.4.4 Magallanes' Specific Political-Economic Context

This leads to the fourth and last point, the political-economic context specific to Magallanes as one of the main frontiers of GH2 development in Chile. The region is geographically completely isolated and only reachable by plane or by driving through Argentina. It is also very sparsely populated and economic activity concentrates on the fading presence of ENAP, salmon industry, sheep farming and tourism (Interview 1, Interview 6). Nevertheless, these industries were never comparable to the north in terms of scale and infrastructure, also the cities are smaller, and the population is "not very accustomed to these large projects." (Interview 8, Pos 108-111). This also means that the region lacks the necessary infrastructure for large-scale GH2 development:

> *"In the end, everything has to be brought in. From the components to make the concrete, the cement, all the steel to build, the food, the infrastructure for the camps. Everything has to be brought in. The shovels—there are no large ports that can unload the wind turbine blades. So, it's a whole challenge of starting relatively from scratch."* (Interview 13, Pos. 260-261)

Furthermore, the lack of industries means that there is basically no local demand for GH2 (Interview 1), which is why all the GH2 projects announced in the area are fully export focused. Another related challenge is the lack of labour, especially trained labour. Due to the low population and relatively high employment, there are not a lot of workers available (Interview 6). This creates challenges, especially for the labour-intensive construction phases, where one project alone would require between 5000 and 10 000 people (Interview 1). During normal operation however, a large-scale project would only require about 100-200 workers, and most of them with specific technical trainings. Therefore, the companies are working with the local university to offer training programs for local students (Interview 1).

However, for GH2 developers, the region remains highly attractive due to several reasons. First, the strong and constant winds make it easier to constantly power electrolysers, in contrast to solar power in the north which either interrupts GH2 production during the night or requires storage options (Interview 8). Second, it is easier for companies to acquire lands:

> *"Here, the land here is so vast, managed by large estates and ranchers, that a company just needs to do business with one or two landowners or ranchers and it's done. And it's a private agreement where the state cannot interfere. That's the big difference. In the north, it's different because the land belongs to the state."* (Interview 6, Pos. 237-238)

Also, the region offers various tax exemption laws (e.g. in Tierra del Fuego) and a free trade zone for imports (Interview 6). Finally, Magallanes is also strategically located at the Strait of Magallanes, which has long been a major shipping route between the Atlantic and Pacific oceans. The straight has recently experienced an increase in ship traffic when the Panama Canal had to limit passages due to droughts. This could create demand for green ammonia to fuel ships passing the strait. Relatedly, the region's ports are also important departing points for missions to Antarctica that could use green ammonia as fuel (Interview 6).

4.5 Historical-Materialist Context of GH2 Development in Chile

To conclude, the emergence of GH2 development in Chile is strongly embedded in the country's extraverted, commodity-based accumulation regime, which has its origins in Pinochet's neoliberal restructuring and was subsequently consolidated during the Concertación period. Contradictions related to extractivist accumulation, such as ecological destructiveness, the dependency on FDI inflows and growing energy demand conflicting with opposition to fossil fuel and hydropower expansion strongly influenced the emergence of a green-capitalist project in Chile, initially materializing post-2014 renewable energy boom. This emergence exemplifies a passive revolution, whereby the neoliberal state resolved crises not by challenging the accumulation regime, but by marginalizing radical opposition to extractivism while incorporating moderate demands for a shift towards renewable energy and adopting "green" growth discourses. The resulting green-capitalist hegemony consolidated after the failed constitutional reform and the weakening of emancipatory civil society contestations following the Estallido Social. This development is a response to the worsening ecological crisis but also a response to the crisis of neoliberal accumulation and the economic recession resulting from the COVID-19 crisis.

The consolidation of green-capitalist hegemony in Chile is furthermore embedded in a more aggressive adoption of ecological modernization strategies in the Global North and their promotion as viable development pathways through international organizations. Chile's GH2 development is thus situated within the broader global power asymmetries that underpin global green-capitalist strategies. As elaborated previously, the highly concentrated control over financial and technological capital in the Global North and China creates structural disadvantages for potential GH2 producers like Chile. Chile's position is particularly precarious given its historical reliance on commodity extraction driven by foreign investment and a related lack of industrial capacities. Furthermore, the global race for "green" technologies and pressures for competitiveness in emerging GH2 markets threatens ecological and social standards. Together with an inherently unequal trade pattern in which commodities are exchanged with higher value-added technologies, this context risks to deepen uneven development and ecologically unequal exchange that has characterized Chile's integration into global capitalism.

These national and global developments provide specific historical-material conditions for GH2 development to emerge as an export-oriented prestige project of green capitalism. The related policy process is strongly influenced by limited state capacities and relative autonomy vis-à-vis domestic and international capitalist elites, which is enshrined in Chile's neoliberal constitution and perpetuated through high-level corruption and close entanglements between political and capitalist elites. The GH2 policy process is constrained by these structural limitations at the national level, manifesting in the state's limited ability to enforce regulation against business interests or adopt a leading role to effectively coordinate GH2 development through ex-ante planning.

Chile's GH2 development is thus caught in the contradictions of the country's specific manifestation of capitalism, in which commodity-based accumulation conflicts with ecological limits and the interests of few capitalist elites traditionally prevail over the needs and interests of the broader population. This indicates that key conflicts shaping the policy process evolve around demands for a more just distribution of socio-economic benefits and the reconfiguration of extractivist society-nature relations, in opposition with interests that approach GH2 as a technological fix to stabilize and thus continue commodity-based accumulation. These conflicts are shaped by the state's limited relative autonomy and its strategic selectivity skewed towards capital interests, as well as the embeddedness in international markets.

These conflicts primarily materialize in the contested GH2 development in Magallanes with its unique political-economic structure characterized by geographical isolation, sparse population, limited infrastructure and a lack of local industries. Power relations are beneficial to large landowners and extractive industries while indigenous communities are highly marginalized. Society-nature relations are historically contested between commodity-exporting sectors such as salmon and indigenous communities as well as social and environmental organizations. Ultimately, the policy conflicts surrounding GH2 development emerge within decades-long struggles over the (re-)configuration Chile's commodity-based accumulation regime and its regulation through a neoliberal state.

Ultimately, the power relations and structures at the local, national and global level apparently favor tendencies towards a deepening of green-capitalist consolidation and subsequently of its inherent contradictions. Nevertheless, past developments have shown that contradictions and crises open opportunities for emancipatory change. To analyse the contestations shaping GH2 development, it is thus necessary to examine the specific interests, strategies and power relations of key actors involved in shaping Chile's GH2 policy process.

5 Key Actors Shaping GH2 Policies in Chile

With the publishing of the National Green Hydrogen Strategy in November 2020, GH2 development officially became a key priority for energy politics in Chile. The policy process, however, starts earlier, in 2014/15 when GH2 was first discussed in the Ministry of Energy, at initiative of GIZ and with involvement of CORFO (Interview 13). The initial interest – to explore ways to exploit Chile's renewable energy potential for exports – is now a key part of the official state objective and represented in both key policy documents. This continuity indicates a significant degree of alignment of the interests among driving actors. Besides green growth, the two main strategy documents frequently frame GH2 as an opportunity for national decarbonization – especially in the country's extractive sectors – and for becoming a key player in the global energy transition (Government of Chile, 2020; Government of Chile, 2024).

The policy process is embedded in broader developments within Chile's political-economic contexts and strongly influenced by the hegemonic green-capitalist mode of development. As such, GH2 policies are supported by substantial parts of the Chilean political and capitalist elite, foreign agencies and international capital, forming a political project centred around the mentioned objectives. However, the actors advancing GH2 developments have specific

individual interests they aim to prioritize, which creates tensions and potentially conflicts. Furthermore, GH2 development as currently envisaged in the key policy documents is opposed by a range of civil society actors, including social and environmental organizations, labour unions as well as indigenous communities. Thus, the key actors shaping GH2 development in Chile include domestic and international state actors, institutions and business actors as well as civil society actors and academia. To establish a basis for exploring the central struggles shaping GH2 policies in Chile, this chapter details the roles, interests and where possible also the strategies of the involved actors to then cluster them accordingly into competing political initiatives.

5.1 Domestic State Actors

The Chilean state is perhaps the most central driver of GH2 development. Advancing export oriented GH2 production has been a key policy focus in both the governments of Sebastian Piñera and Gabriel Boric, a continuity that is characteristic to Chile's neoliberal, technocratic energy politics (Interview 12). GH2 became a central state project at latest with the establishment of the Green Hydrogen Industry Development Committee (Comité de Desarrollo de la Industria de Hidrógeno Verde) in 2022, an interministerial committee that involves 11 ministers and CORFO's vice president as well as the governors of Magallanes and Antofagasta. The GH2 policies thus represent a shared effort of the highest political levels.

> "*The State is a strong driver of this today, it is probably one of the most interested [actors], the most interested are the ministers, the presidents as we said before, the regional government [of Magallanes] is the most enthusiastic because they see it as a possibility within the framework of growth.*" (Interview 10, Pos. 133)

The strong support of the regional government is especially important for legitimizing GH2 development at the regional level and complicates local opposition. Furthermore, the regional government is responsible for the regional territorial management plan (plan de ordenamiento territorial) that is key for coordinating the development of infrastructure and public services to facilitate (or hinder) GH2 development (Interview 4, Interview 6). However, decision making power in GH2 development is strongly concentrated in the national government in Santiago (Interview 5) – a manifestation of Chile's highly centralized state and as such, a legacy of Pinochet's neoliberal dictatorship. This is expressed, for example, in the initial lack of regional involvement in the GH2 logistics technical committee. According to a local CORFO official,

they had to push for representation, saying "You can't be deciding on ports in our region from Santiago by people who aren't from here" (Interview 6, Pos. 432). A local indigenous leader frustratedly concluded that "not even the regional government makes the decisions, the industry does" (Interview 7, Pos. 50).

Among the involved state actors from the central government, there are different perspectives, strategies and objectives that result from their composition, institutional embeddedness, relation to civil society and general function within the state apparatus. The Ministries of Energy and Economy are clearly the main drivers, within the latter primarily the agency for productive development CORFO. A high-level official from the external ministry's export promotion agency ProChile explains their roles as follows:

> *"Yes, [the Ministry of Energy] is closely working with CORFO and this committee—a green hydrogen development committee led by CORFO. I'd say there's a fairly balanced dynamic between the Ministry of Energy, which handles the sectoral aspects, and CORFO, which focuses on productive development."* (Interview 9, Pos. 252-260)

Both ministries are important key drivers, but the Ministry of Energy is taking the lead in developing the general strategies, objectives and related regulations, while CORFO is more engaged in implementation, project development and promoting economic linkages (Interview 11). Other central state actors are the Ministry of Environment, especially its subordinated agency for environmental evaluation SEA, as well as state-owned petroleum company ENAP. Furthermore, the agencies InvestChile and ProChile are central to the implementation of the current strategy but play a less important role in the overall policy development. InvestChile's task is to attract and facilitate foreign investment, so the agency is directly engaged with foreign capital interested in developing GH2 projects in Chile and in that also cooperates closely with CORFO (Interview 9). ProChile's task on the other hand is to promote exports from Chile, for example connecting businesses in Chile to potential international GH2 offtakers or related products and services, like GH2 consulting companies for example (Interview 9). The following section explores in more detail the roles, interests and strategies of the four most significant state actors, starting with the two key drivers.

5.1.1 Ministry of Energy

The Ministry of Energy is responsible for incorporating GH2 into broader national decarbonization plans for achieving the NDC goal of climate neutrality by 2040 (Interview 11).

Furthermore, the Ministry was early on motivated by economic interests, especially the potential of GH2 for diversifying the Chilean export basket. The very first studies that the Ministry of Energy and CORFO did in 2017 – at the initiative of GIZ – were looking into "how to take advantage of the enormous renewable energy potential we had" and that GH2 "was seen as a great opportunity to export electricity" (Interview 11, Pos. 39-40). In 2019, the ministry took the lead in drawing up and publishing the 2020 National Green Hydrogen Strategy. The consultancy McKinsey & Company was hired for drafting the strategy, and CORFO and GIZ were also involved (Government of Chile, 2020). As already detailed, the strategy was highly optimistic and posited that exploiting Chile's renewable energy potential for GH2 exports could create a sector "as large as the Chilean mining sector" (ibid., p. 12). In hindsight, the strategy is regarded as "overly ambitious, nowadays, everyone here laughs about the [numbers]" (Interview 12, Pos. 113).

In relation to the potential of GH2 in decarbonizing Chile's domestic economy, the Ministry of Energy early on concluded that the main opportunity is to green other export sectors:

> "*There were sectors that otherwise were very difficult to achieve [decarbonization]. So, there we also saw this key opportunity in mining, for example, in industries, etc., in long distance transportation (…) So, we began to talk about green copper, for example, low-emission copper (...) we are also studying green maritime corridors. If copper, for example, is extracted with low carbon, it also must be transported with low carbon"* (Interview 11, Pos. 48-59)

Decarbonizing these export-oriented sectors is also a central technological fix to allow continued commodity-based accumulation in a decarbonizing world where adjustment costs are increasingly shifted to the Global South. As argued by a ministry representative, "access to certain markets will be restricted if it doesn't meet low-carbon criteria. In this context, Chile is working to ensure it can continue exporting copper to Europe once such requirements are in place" (Interview 11, Pos. 265).

Since GH2 remains costlier than its fossil counterparts in the foreseeable future, some within the ministry are open to a more interventionist approach in which the state would drive domestic GH2 adoption more directly, e.g. through offtake quotas for local businesses (Interview 11). Currently, however, a laissez-fair approach prevails in which the role of the state is limited to that of a coordinator, to "create the conditions for the private sector to make

investment decisions" (Interview 11, Pos. 128). In that context, the ministry's approach is that first GH2 production needs to scale through export-oriented project so that abundant cheap GH2 becomes available, and then local off take will commence and contribute to domestic decarbonization (Interview 11). To conclude, the Ministry of Energy is mainly interested in two key aspects of GH2 development: the potential to export renewable energy, and the opportunity to green energy intensive extractive industries and thus stabilize the commodity-based accumulation regime.

5.1.2 CORFO

CORFO, the agency responsible for promoting productive development, has a long history in promoting export-oriented commodity sectors (Lebdioui, 2019). The agency is a very vocal supporter of GH2 and eager "to build this imaginary that Chile is going to develop with this" (Interview 10, Pos. 111). Its central interest is to promote the development of GH2 production and GH2-based green industrialization (Interview 14). In that, CORFO's discourse heavily employs green growth narratives, and "they also talk about the concern for the environment. I cannot presume that they are lying, but (…) their priority is in economic development and the environment in the long run is not very present" (Interview 10, Pos. 17). CORFO's role in the GH2 policy process is twofold: first, it is the central implementor of state actors and measures, and second, it fulfils important coordinative functions. In 2022, the Ministry of Energy created the Green Hydrogen Industry Development Committee which is chaired by the Minister of Energy but led by CORFO. The interministerial committee involves 11 ministers and CORFO's vice president, and has the objective to coordinate "the creation of public policies to harness the opportunities of this combustible" (CORFO, 2022). Today, the CORFO-led committee coordinates and oversees the implementation of the measures detailed in the 2024 Green Hydrogen Action Plan and is responsible for identifying and addressing potential policy gaps (Government of Chile, 2024). In addition to its high-level coordination, CORFO as a decentralized agency is also strongly present at the regional levels (Interview 6).

Generally, the agency has two main objectives: supporting the development of GH2 production capacities but also establishing economic linkages to other sectors. For the first objective, CORFO strongly focuses on the supply side, with measures that range from the organization of GH2 summits for businesses and other international actors to the financing of R&D projects (Keller, 2025). Perhaps the most significant measure is the creation and management of the $1 billion USD financial facility with the objective to attract private investments by de-risking GH2 production projects. The facility is compiled of several loans

by international actors, such as the World Bank ($150 million USD), the Inter-American Development Bank ($400 million USD), the European Investment Bank ($110 million USD) and the German development bank KfW ($110 million USD), with the rest financed directly by CORFO (Martin, 2023). These loans are a debt taken on by the Chilean government that need to be paid back if the projects fail to develop (Interview 14), a scheme that "could, indeed, lead to a debt trap" (Scholvin et al., 2025). Also, even though the distribution of funds is administered by CORFO, their potential uses (e.g. credit lines or subsidies) were determined beforehand in agreement with the lenders (Interview 14), further limiting sovereignty.

To create economic linkages, the agency works both down- and upstream. Downstream, CORFO in 2018 was first and foremost "interested in seeing how it could work in mining" (Interview 13, Pos. 9), and did some technical studies about using GH2 to decarbonize certain processes in copper mines (Interview 14). Later, it began to broaden its scope to other potential off-takers, and in 2023 it selected five projects to receive $3.5 Million each, including a project on fertilizer production, GH2 powered trucks and GH2-run forklifts (Interview 14). CORFO also tries to create downstream linkages in Magallanes, but due to lack of industries, they will mostly be indirect. Mentioned examples included attracting construction companies to respond to the increased demand for housing, or greenhouses to address the increased demand for food. Potential direct linkages are limited to the expansion of port infrastructure and the opportunity to sell GH2-based fuel to international fleets (Interview 6).

Upstream, CORFO issued a call in 2021 to attract corporations interested in manufacturing or assembling electrolysers in Chile, offering $50 million in subsidies (Interview 14). By March 2025, three out of the ten interested companies were selected to receive an additional $25.6 million in funding if they decide to follow up on their proposals. These include two factories for assembly and one for production to be located in the Metropolitan and Bío-Bío regions, that together would amount to $50 Million in investments (CORFO, 2025). CORFO is also trying to attract the production of wind turbines to Chile, but there has not been a lot of interest due to the strong competition by China and the lack of a sizeable market (Interview 14). In Magallanes, CORFO is conversing with Danish companies to attract the manufacturing for the wind towers (Interview 6). This seems little likely, however, given the geographical isolation from other markets and the lack of existing industries (Interview 8). More plausible are linkages to suppliers and service providers: "whether it's food or maybe even parts and components for the industry, but also (…) just imagine, HNH has a camp with 3,000 people, who's going to wash

3,000 sets of sheets?" (Interview 6, Pos. 342). Such upstream linkages however are very limited in their potential to capture value or create further linkages.

5.1.3 Ministry of Environment and SEA

In contrast to the state actors mentioned, the Ministry of Environment has not been particularly active so far, despite the potentially massive ecological implications of such large-scale productive developments. According to a researcher of Chilean energy policy, it has acted as a bystander at best:

> *"The Ministry of Environment has distanced itself, I'm not sure if they chose to or if they were pushed aside, because they're not talking about this and are letting others speak on the matter. They don't even go so far as to say, "We also want to be involved". It is as if they are watching what's happening without the ability to take action"* (Interview 10, Pos. 21).

A civil society representative opposing GH2 development has also voiced strong criticism of the Ministry, arguing that its involvement is only officially required and in practice is "minimal and occasional" (Interview 5, Pos. 51). In stark contrast, one business representative complained that the Minister of Environment is too active and demanding (Interview 8). This indicates that the extent of environmental regulation of the industry is a key arena for contestation.

The environmental evaluation agency SEA, subordinated to the Ministry of Environment, however, takes a central role in all GH2 developments. It is responsible for coordinating the evaluation of the environmental impacts of GH2 projects and for creating the final evaluation report which recommends the approval or rejection of the environmental license. Social impacts are not analysed, neither in this evaluation nor in any other obligatory process. In 2023, a technological baseline for assessing GH2 projects was adopted, but generally, the regional SEA offices work quite independently (Interview 4). An SEA official in Magallanes emphasized the importance of a rigorous environmental evaluation to minimize the negative impacts of the industry, as well as the significance of citizen participation for this process (ibid.). The complexity and scale of the proposed projects – including the biggest project in the history of the SEA by HNH Energy –presents considerable challenges to the small team.

Therefore, the regional manager is constantly engaged in talks with the central government, demanding an expansion of the team and overall capacities. Furthermore, the team also

"encourage[s] developer companies to engage with us early and continuously, on a permanent basis" (Interview: 3, Pos. 22) to help them avoid broader mistakes and better manage the workload. Still, those sceptical of GH2 development in the region are concerned that "the Environmental Assessment Service [is] overwhelmed—they're among the services with the highest number of medical leaves, facing a massive workload, and have asked for national-level support" (Interview 5, Pos. 51). Scepticism is shared by industry representatives, that have also questioned the SEA's capacities but are primarily concerned about the length of the environmental evaluation process (Interview 8). These different interpretations and expectations from the SEA indicate that the environmental assessment is also a central issue of conflict.

5.1.4 ENAP

State-owned enterprises – above all ENAP (oil) and CODELCO (copper) have only been limitedly involved, despite their potentially central role as project developers and/or offtakers (Interview 12). According to a state official, the management of these companies is however not steered by the state, rather they act just like business actors with the central objective "to be profitable (…) it's ultimately the numbers that drive it" (Interview 11, Pos. 132-133). However, due to its presence in the region of Magallanes and its technical expertise with hydrogen, ENAP is slightly more engaged. ENAP has long used hydrogen in its refineries and could also be an important off-taker by substituting the grey hydrogen currently used in this process. Such plans are however complicated by existing long-term contracts (Interview 2). More direct involvement in GH2 development, i.e. through proper GH2 production projects of any significant size, is currently not within the interests of the company due to the significant uncertainties surrounding GH2 markets (Interview 3). Also, the company would need to mobilize substantial capital. An ENAP official explained the company's interest as follows:

> *"[A]s ENAP, we don't currently see it as viable to take on that kind of debt. We believe our role lies more on the logistics side. And in the future, as this sector consolidates, as I mentioned earlier, we're talking with some actors about possibly taking equity options or off-take agreements."* (Ibid., Pos. 445-448).

Thus, the company's priority is principally GH2-related logistics, but they also offer services like providing expert knowledge to companies. ENAP has also voiced these preferences in the technical groups and other participatory forms within the GH2 policy process

– with success, since the preferences are directly reflected in the government's GH2 Action Plan (Interview 3). In it, ENAP is primarily tasked with developing infrastructure such as ports in Magallanes, "in cooperation with third parties" (Government of Chile, 2024). In practice, ENAP tries to sign collaboration agreements with potential project developers if their plans synergize with the interests of ENAP. However, this is voluntary, in the sense that companies do not need to cooperate and can develop their own infrastructure. As of September 2024, "we've signed more than 15 collaboration agreements. If you total up the equivalent in electrolysers, it amounts to more than 30,000 megawatts" (Interview 3, Pos. 16). By coordinating these developments, ENAP would also reduce ecological impacts associated with the massive infrastructure required (e.g. building one instead of several ports). The official was furthermore open to expand ENAP's future involvement:

> *"why, instead of building ammonia plants in different locations, don't we build one large ammonia plant in a coastal area? Then, instead of moving ammonia, you transport hydrogen, and I run a maquila-type ammonia plant at the port. So, you give me the hydrogen, and I deliver the ammonia at a port—for all of you."* (Interview 3, Pos. 376-378)

At the same time, however, the official was eager to point out that as of now, the industry does not exist yet and must first confront substantial challenges, especially related to the lack of demand.

5.2 International Organizations and Agencies

Among the international organizations, the World Bank has been a particularly relevant driver of GH2 development in Chile, together with foreign state agencies. As already mentioned, the World Bank has provided a $150 Million loan to Chile to de-risk private investments. But not just that, the organization had started to provide technical assistance already in late 2020, analysing ways to promote domestic GH2 applications. Due to the uncertainties related to supply and the high prices, they began to work with the Ministry of Energy to push the supply side (Interview 15). According to a World Bank representative, the organization subsequently came up with the proposal to create de-risking measures:

> *"we said, listen, this is to lower the cost of production and reduce the risk perceived from investors, from contractors, and from the overall sector. So basically, what we proposed is a facility where our funding would address this risk"* (Interview 15, Pos. 10)

Later, other banks joined, and the $1 Billion financial facility was created. Afterwards, the World Bank's involvement was mostly limited to cooperating with CORFO in the distribution of the funds (Interview 15).

5.2.1 Foreign State Actors and the GIZ

Partnerships with foreign states are fundamental for Chile to secure future destination markets that are central for export-oriented GH2 development. To that end, Chile has already signed collaboration agreements with several states such as Singapore, Japan, Korea, Indonesia, France or the UK. Beyond that, however, these states are not significantly involved in the policy processes (Interview 11). This is different for the EU, which, as mentioned, is leading in the development of certification standards, thus influencing project designs, and has also provided a loan for CORFO's financial facility, among other measures. Of all state actors, however, Germany has clearly been the most active, especially through its development agency GIZ:

> *"I believe the German cooperation is the main international driver in this area. (...) None of them are close to the magnitude of what [the GIZ] is doing, it's truly impressive. (...) They're simultaneously funding environmental studies, economic studies, and being very careful not to come across as colonialists. But in the end, the logic is to produce the hydrogen here, since they do not have the territory to produce it in on their own."* (Interview 10, Pos. 137)

The GIZ is supporting Chile in its energy transition since 2008 (GIZ, 2021), and cooperated closely with the Ministry of Energy where it started to bring up hydrogen around 2014 (Interview 13). A representative of the agency describes the process as follows:

> *"So, we internally discussed here with the director that Chile has the energy—meaning, it has the capacity to produce hydrogen from renewable energy, due to the abundance of resources available, but it also has the capacity to produce it at a very competitive price. (...) At that time, they weren't necessarily focused on this topic as a priority. So, from 2015 to around 2018, we carried out a kind of awareness campaign, publishing a book about hydrogen and Chile's potential, etc. Finally, the Ministry of Energy took it up and started developing it."* (Interview 13, Pos. 7-10)

It is fundamental to highlight the importance of this process. Setting an agenda and bringing up a policy issue in a certain way automatically creates a certain playing field, so that the initial definition of a policy issue largely determines its subsequent treatment in the policy process, and thus also strongly influences the outcome (Rochefort & Cobb, 1994). In line with that, the GIZ' initial framing of hydrogen as an opportunity for exploiting Chile's renewable energy potential by turning it into a sellable commodity is at the heart of the current GH2 strategies of the government.

Furthermore, not only did the GIZ bring up and define the policy issue initially, it also invested considerable resources to make it a policy priority in Chile. In addition to financing studies on techno-economic feasibility and regulatory enablers, the agencies' early promotional work also included the organization of the first hydrogen summits in 2017 (Interview 13). Today, GIZ continues to cooperate closely with the Ministry of Energy and also increasingly with CORFO. Its work covers all possible institutional matters: "regulation, certification, tax incentives or reducing permitting times" (Interview 13, Pos. 86). According to a ministry representative, the GIZ team provides technical assistance, finances studies where needed and is "very proactive and often propose or push for certain studies, which we then agree on collaboratively" (Interview 11, Pos. 241-249). A possible explanation for such a central role of a foreign state actor in Chile's GH2 policy development is the chronic understaffing and lack of capacities in most of the Chilean state apparatus.

In addition to its strong engagement with key state actors, GIZ is also closely cooperating with business actors. According to a GIZ representative, the agency even established the business association H2 Chile, which initially included predominately international capital (Interview 13). While officially, GIZ stepped back from the association, it continues to be associated and continues in "bridging the gap between government and private sector – essentially, we act as an interface between the government and private sector" (Interview 13, Pos. 42-43). The reasoning is that in Chile's privately-driven GH2 development, only the private sector can know "where projects get delayed, where the gaps are, and what is needed" (Interview 13, Pos. 87). GIZ then sees its role in articulating those needs to public officials. In addition to that, the agency has recently also started to provide direct financial support to project developers (Interview 12).

The interests of the GIZ are naturally strongly aligned with the overall interests of the German state. Germany is a key driver of GH2 development in the EU and globally. The GIZ has been involved in hydrogen developments of numerous countries in the Global South,

including Tunisia, Algeria, Marrocco, Namibia and Chile, among many others (Quitzow et al., 2023). On the one hand, Germany aims to secure access to cheap green energy imports from a diverse set of sources, to avoid future price shocks. On the other hand, it is interested in exporting advanced equipment and technologies necessary for GH2 production (Interview 12). For both, it is attractive to have as many potential projects in as many potential producer countries as possible. This is also true for GH2 development in Chile:

> *"[The interest is] to have a partner that can produce a fuel or an energy that is convenient for Germany and Europe, right? And at the same time, if those projects are developed, there will obviously be European and German components or companies working on those projects. Technological transfers, transfers of equipment, engineering, etc. (...) There is a reason why they are also very interested in developing these projects, beyond just cooperation, right?"* (Interview 13, Pos. 92-95)

To conclude, the role of international actors has been decisive, especially for the case of GIZ. Despite its official neutrality, the German development agency's motivations go way beyond mere developmental cooperation and apparently involve a strong interest in promoting the external economic interests of German businesses. The agency's massive influence and role as an interface between business actors and the public sector has clearly contributed to the export-oriented, large-scale GH2 development pathway envisaged in the current strategy.

5.3 Business Actors

International capital, mostly from Europe, clearly dominates GH2 development in Chile (see Table 1). Among the 24 GH2 projects with more than 100 MW production capacity announced so far, only four are by Chilean developers, while three have Chilean companies involved (H2Chile, 2024). However, even the projects by Chilean developers depend on international capital due to several reasons. First, export-oriented GH2 projects need to be large-scale to make economic sense, especially given the transporting distances involved for a country like Chile. Such projects require immense financial and technological capital, which, as mentioned in subchapter 5.3.6, is often controlled by international business actors, or at least they have easier access to it. Second, these projects include a lot of risk and uncertainty, which benefits big corporations with access to more capital and capacities for risk absorption over smaller ones. Therefore, according to a hydrogen consultant, "there are at most a few Chilean project developers, very few, who are also composed of various investors" (Interview 12, Pos.

151). This explains the domination of large corporations, among them predominately European capital, clearly dominate.

Their projects are predominately export-oriented, given the lack of local demand. According to data by H2Chile, among the 24 projects bigger than 100MW production capacity, only two have stated to focus on internal demand, two combine exports and internal markets while the remainder is only focusing on exports. Most of these projects produce ammonia, only three have indicated to produce hydrogen, two eFuels and one methanol (H2Chile, 2024). In addition to GH2 production itself, other involved private actors include suppliers and off-takers. In Chile, this involves most notably the mining sector which as mentioned has so far shown only limited interest, with the exception of AngloAmerican (Interview 11). However, the mining sector's cautious approach also shapes the policy process by contributing to the lack of local demand, thus requiring an even stronger export orientation. Furthermore, given the lack of domestic industrial capacities, the key suppliers and offtakers for GH2 production are also dominated by international business actors. A case in point is the Faro Sur project developed by HIF, which uses electrolysers supplied by SIEMENS and is selling eFuels to companies such as Porsche (Interview 3, Interview 5).

Table 2: The six biggest hydrogen projects in Chile by December 2023 (H2Chile, 2023)

Project	**Capacity (MW)**	**Market**	**Company**	**Country**	**Region**
H2 Magallanes (Total Eren)	8000	Export	Total Eren	FRA	South
HNH Energy	1400 (up to 6000)	Export	Austria Energy, CIP, Ökowind	AUT, DNK	South
Acuario, Sagitario	2500 + 2500	Export	Consorcio Austral	CHL	South
Gente Grande	3200	Export	TEG Chile	UK	South
Los Amigos del Verano	2500	Export + Internal	SIEMENS, Verano Energy	GER, International	North
Energía Verde Austral, Punta Delgada	1000 + 1500	Export	EDF Andes, EDF Renewables	FRA	South

The relevant business actors in the GH2 ecosystem – from energy corporations and project developers to technology producers or off-takers – are organized in various business

associations. There are important global associations that have been incremental drivers of global H2 developments, above all the Hydrogen Council, which was founded by the CEOs of fourteen transnational corporations, or Hydrogen Europe (Vezzoni, 2024). Their members include powerful oil and gas companies (e.g. Total, BP), actors from the automotive and chemical industries (e.g. Porsche, Air Liquide), mining (e.g. Anglo American) as well as shipping and aviation giants (e.g. Maersk, Lufthansa). Chile also has a national H2 business association called H2Chile, which, as mentioned, was founded by the GIZ and today boasts more than 100 associated companies. Like its international counterparts, H2Chile is dominated by large multinationals. Early drivers were energy corporations such as Engie or AES Andes, and technology providers like Siemens (Interview 13). As pointed out by Vezzoni (2024), these companies are often interested in hydrogen allows so to continue, expand and greenwash their business models within the green-capitalist project.

However, following an initial hype, the spirit within the private sector in Chile has calmed down, and as of 2024, most business actors are a lot more cautious regarding GH2 development (Interview 9). Industry representatives have blamed that on several challenges. First, international demand is developing much slower than expected, a fundamental challenge which in the case of Chile is aggravated by the lack of domestic demand (Interview 8). This is also the central reason for why no investor had made a final investment decision by October 2024, since "there are no commercial banks that would easily fund these projects, and having an offtake agreement is a key requirement" (Interview 12, Pos. 36). Industry representatives have further complained about the lack of financial de-risking schemes in Chile. While they regarded the financial facility as an important step forward, they claimed that it took too long to set up and are not yet convinced of its efficiency (Interview 1, Interview 8). Furthermore, the facility is only for projects with a final investment decision in place, which none has made so far. Thus, companies have started to request financial support for their pre-FID expenditures from CORFO, saying that they "need more pre-FID money to get to the FID" (Interview 14, Pos. 77). Private actor representatives have been very blunt in demanding public de-risking:

> *"Yes, a company like ENGIE or EDF probably has the money. But it's still money that, if there's a risk of losing it, is 100% at risk (...) [so we tell the government] well, help me with the development, take the risk together with me, and be prepared to lose that money you're subsidizing, because I'm not willing to take on 100% of the risk alone."* (Interview 8, Pos. 228-229)

To support their demands, both business representatives referred to global competition and that other states offer better conditions, for example contrasting Chile's financial incentives with those offered by the US or Europe (Interview 1, Interview 8). One representative also highlighted the issue of permits, especially environmental evaluation, demanding flexibilization and clearer rules. According to that person, obtaining an environmental permit in Chile takes too long, is very expensive, more demanding than elsewhere and often results in subjective decisions (Interview 8). This is part of a wider strategy, as argued by a Chilean researcher:

> *"When they say they want clear rules, I think one can read between the lines that they want rules that are more favourable to them. Because the rules are actually quite clear. It's just that they are demanding, and there are many opportunities to appeal. That's why the process is so slow, and that's where the concern lies."* (Interview 10, Pos. 45-50)

Such demands point at a broader conflict concerning the environmental regulation of GH2 and other green-capitalist projects in Chile.

To conclude, private actors, especially international capital mostly from Europe, are fundamental actors of Chilean GH2 development. They are organized in business associations to push favourable regulation, and include actors from the energy sector, particularly oil and gas, steel, automotive and chemical industries, mining, shipping and aviation. Embedded in the emergence of a global green-capitalist project, they are motivated to continue and expand their business models into new "low-carbon" sectors. In Chile, private actors have been vocal in demanding concessions from the state, especially regarding financial de-risking and the flexibilization of environmental permitting.

5.4 Civil Society Actors

Civil society actors shaping the GH2 policy process in Chile include labour unions, indigenous communities as well as social and environmental organizations. Among the general population, GH2 development has so far not been substantially problematized, and discourse is dominated by framings depicting GH2 as a new, clean growth opportunity (Interview 5). In contrast, the mentioned civil society actors, together with some critical academics largely oppose large-scale, export-oriented GH2 development as envisaged by the current government. As of April 2025, opposition is mainly concentrated in Magallanes, where social and environmental actors have established the citizen platform Panel Ciudadano H2 Magallanes. While sharing rejection of the official GH2 policies and disappointment with the government's

performance, the extent of opposition differs among relevant civil society actors. Also, they follow different interests and strategies, and command varying degrees of resources and influence.

5.4.1 Panel Ciudadano H2 Magallanes

The panel consists predominantly of social and environmental organizations and individual activists that oppose current GH2 development in Magallanes and beyond. It includes organizations both from the regional level (e.g. ACUE) and from the national level (e.g. FIMA). The panel is also working closely with an advisory board of critical academics and furthermore cooperates with representatives of indigenous communities opposing GH2 development (Interview 7). Regarding its structure, the panel resembles a broad platform that strategically focuses on the environmental assessment process:

> *"The panel is a collaborative, associative alliance where each organization maintains its independence and contributes only from its specific area of expertise.(...) [It] has a clear strategy focused on influencing citizen participation through technical observations, (...) mainly focused on evaluating projects and submitting observations, but it's not oriented toward sharing or socializing that information with the broader community; that's simply not part of its objective."* (Interview 5, Pos. 100)

According to a member, this organizational form and strategy creates strengths but also weaknesses. On the one hand, the panel's loose organization and clear strategy allows for a broad platform in which organizations from diverse social contexts can participate but also pursue individual strategies. On the other hand, the focus on the environmental evaluation process is highly technical work that presupposes high levels of expertise which could potentially create an impression of academic elitists disconnected from society's interests (Interview 5). However, since participating organizations are open to pursue proper strategies on their own, some organizations try to make the discourse about possible implications more accessible and "talk about how this could affect your everyday life" (Interview 5, Pos. 114).

Just as the various actors involved differ in terms of their background and strategic approaches, they also differ in their general opinion of GH2 development. The panel includes more radical positions that reject any form of GH2 development, even at smaller scales, but those form a minority. Several organizations either see some positive aspects in small-scale GH2 production or accept that the industry will install and seek to limit its implications by

promoting smaller-scale projects or technologies. Ultimately, the actors agree in rejecting the large-scale, export-oriented design and overall extractivist character of the current strategy (Interview 5, Interview 7). As stated by a member of the panel:

> *"Hydrogen, as it is currently envisioned, is purely extractivist – meant to be exported to Europe – with no development of hydrogen technologies within Chile, no benefits for Chilean citizens, and no strategy to transition Chilean cities to renewable energy. It's entirely controlled by private actors seeking profit through fuel exports. Everything revolves around extractivism: the only significant plan for using green hydrogen domestically relates to large-scale mining, aiming to give it a "green" label, so the focus remains firmly on extractivism."* (Interview 5, Pos. 10)

Strategically, they agree on the overarching objective to slow down current GH2 development and limit the potential social and ecological implications. To that end, the panel has also sent a letter to the regional governor with several relatively modest demands, including: more transparency and information about the possible implications; clarification about overall number of projects to be installed and their territorial occupation; the strengthening of environmental institutions, especially the SEA; as well as lastly, and most importantly, an integrated prior evaluation that considers the effect of "all the projects together, and not on a per-company or per-activity basis" (Panel Ciudadano H2 Magallanes, 2023). However, they did not receive an answer from the governor and are now aiming to halt or at least slow down projects by entering citizen observations during the environmental evaluation processes.

5.4.2 Indigenous Communities

Significant parts of the Kawésqar indigenous communities in Magallanes share the Panel's dissenting stance and, on that basis, they frequently cooperate with the Panel. However, not all within the community share this opposing perspective and some even support GH2 development, which is why it is fundamental to keep the struggles separated, according to a local indigenous leader: "Together, we all push in the same direction, but in the case of indigenous peoples, there must always be autonomy—autonomy and self-determination in terms of their struggle" (Interview 7, Pos. 182-184). This struggle is highly precarious, since indigenous communities in Magallanes have been heavily marginalized and are excluded from proper consultation when it comes to GH2 development:

> *"However, both from the central government and the regional government, the possibility of holding the consultation was denied. They claim that the projects will not affect any Indigenous communities whatsoever. That's the context we're facing in terms of the degree of influence we will actually have over whether or not this industry is ultimately established."* (Interview 7, Pos. 6-7)

This exclusion of indigenous communities reflects a broader pattern of extractivist society-nature relations, where marginalized voices with alternative perspectives are systematically silenced to maintain the dominant commodity-based accumulation regime. Traditional relationships to land, water, and ecosystems are suppressed and sidelined to allow for an extractivist utilization of nature.

Speaking for those indigenous people that oppose GH2 development in the region, the community leader highlighted that this exclusion is against their rights before the law, which is why they are requesting the incorporation of indigenous consultation in the environmental evaluation. Although their territory is officially not affected because their right to the lands is not recognized by the government, the representative cited impacts on ancestral burying sites and ecological effects on maritime ecosystems that are part of their cosmovision (Interview 7, Pos. 42). By demanding consultation, they hope to "significantly minimize the damage that may be caused (…) for example by the desalination plants that are going to dump their tailings into the sea" (Interview 7, Pos. 40-24). The representative was committed to fight for their right to proper consultation through the environmental courts, if necessary. This approach has already stopped local projects in the past (Interview 4). While the indigenous leader is strictly against GH2 development in the region, they also see room to compromise. If ecological implications are minimized, "surely we can aim to produce something in a more sustainable and sustainable way" (Interview 7, Pos. 52-53).

5.4.3 Labour Unions

Labour unions in Chile, united in the "Centro Unitario de Trabajadores", in short CUT, have been largely excluded in the GH2 policy process. According to a high-level union representative, this was not surprising during the right-wing Piñera government, but exclusion continued after Boric became president. A particularly noteworthy example is the exclusion from the strategic green hydrogen committee, which had the objective to create a broad consensus over GH2 development from all parts of the political, economic and academic elites

(Government of Chile, 2023). The 10-person high-level advisory council consisted of renown academics from different fields, prominent (ex-) politicians from all couleurs, the governors from Magallanes and Antofagasta as well as the director of the neoliberal think tank 'Libertad y Desarollo'. However, no representative of CUT was invited – even though the two parties closest to the labour union, the communist party PCCh and the socialist party PS, were both part of the governing coalition led by Boric. This was strongly criticized within the union (Interview 2).

Exclusion from the GH2 policy process clearly also has to do with the lack of power due to low unionization and even less collective bargaining in Chile generally and an even more precarious situation in the energy sector (Interview 2). Nevertheless, CUT tries to influence GH2 policies wherever possible, and its connections to some of the governing parties in Boric coalition as well as participatory spaces such as labour councils create some potential for that. However, these participation mechanisms are usually little more than discussion fora that lend legitimacy but do not allow participants to directly influence decisions. The consequence is that "in the end, decisions are often made based on business interests." (Interview 2, Pos. 424)

In its challenging quest to influence GH2 development in Chile, CUT is strongly pushing the idea of GH2-based industrialization but also voiced concerns over ecological implications. For the latter, the union has highlighted the need to limit environmental impacts as much as possible and criticized the lack of regulation of desalination plants (Interview 2). Also, the union emphasizes that GH2 should first cater to domestic green energy needs before targeting export markets. The union representative is quite critical of the state's laissez-faire approach: "What worries us is that green hydrogen could end up like Chilean copper, where today, 78% of the wealth from copper goes abroad" (Interview 2, Pos. 8). To achieve GH2-based industrialization, the union representative demands the state to lead GH2 development and for that, "we need to move away from this subsidiary state toward a strong state, a state that provides protection, that guarantees rights, and that regulates." (Interview 2, Pos. 274).

Despite the challenges resulting from the limited capacities of the neoliberal state and the constraints resulting from the extraverted accumulation regime, CUT also sees opportunities and pathways towards GH2-based industrialization. The union argues that the state-owned petroleum company ENAP should lead GH2 development: "ENAP has been working with hydrogen since the 1940s (…) so it surprises us that ENAP isn't leading this topic, that it's being led by private companies instead" (Interview 2, Pos. 8). When asked about this, an ENAP official argued that in light of the limited capacities, the substantial uncertainties and the

intensity of financial and technological capital, it would be highly complex and challenging but also risky for the state to lead GH2 development through ENAP (Interview 3). Acknowledging these difficulties, CUT also demands that the character of state-owned companies need to be reformed and strengthened:

> *"They [state owned companies] were incorporated in neoliberal business practices and had to enter the market. So, what bothers me is that the national companies aren't being strengthened. Like ENAP, like Codelco, for example. It took a lot of effort to get Codelco involved in the lithium issue. And it's been extremely difficult to get ENAP involved in the hydrogen sector."* (Interview 2, Pos. 53-54)

The labour union is thus primarily interested in getting the state-owned companies involved in the broader GH2 development, a strategy which they have also pursued in the lithium with some success.

5.5 Political Initiatives

Based on the detailed actor analysis, three main political initiatives emerge around green hydrogen (GH2) development in Chile, each representing different actor coalitions with shared interests and objectives. In the following categorisation into three initiatives, the thesis builds on a previous analysis of contested GH2 developments in South Africa by Kalt et al. (2023) which is modified and adapted to the Chilean case study. The initiatives capture the contested nature of GH2 policies and demonstrated how they relate to broader hegemonic projects in Chilean society.

5.5.1 Export-Oriented Green Capitalism

The export-oriented green capitalism initiative represents the dominant political project shaping GH2 development in Chile. This initiative includes domestic state actors—primarily the Ministry of Energy and CORFO, international capital (especially European firms like Total Eren and Austria Energy), foreign state actors (particularly Germany through GIZ), international financial institutions (World Bank, IDB, EIB), and business associations like H2Chile. Their common objective is to exploit Chile's renewable energy potential through large-scale GH2 production for export markets, positioning Chile as a global leader in "green" commodity production and attracting foreign direct investment for green-capitalist projects. This initiative is strongly embedded in the dominant green-capitalist mode of development and

seeks to stabilize Chile's existing extraverted, commodity-based accumulation regime by decarbonizing extractivist sectors and diversifying commodity exports. GH2 development along these lines is legitimized by narratives of green growth and green extractivism.

The initiative follows a decisive laissez-faire approach in which GH2 development is facilitated by the state and primarily driven/executed by business actors, mostly from Europe. In this initiative, economic growth is clearly prioritized over environmental implications. This initiative reproduces and reinforces the state's strategic selectivity towards the dominant extraverted capitalist elite and thereby perpetuates Chile's neoliberal model characterized by limited relative autonomy of the state. The state's role is limited to that of a coordinator, to "create the conditions for the private sector to make investment decisions" (Interview 11, Pos. 128). The initiative thus stabilizes and reproduces existing power relations and dependencies on international capital and markets. In terms of society-nature relations, it intensifies the commodification of renewable energy resources as natural elements (wind, sun) are transformed into exportable commodities. Concerns over local social and ecological implications voiced by local communities and organizations are sidelined, contributing to a further marginalization, especially of indigenous communities. This is evident in the scale of proposed projects, like HNH Energy's 6000 MW development and their immense territorial footprint, as well as in the regional governor's failure to address related citizen concerns. The initiative aligns perfectly with what Dorn et al. (2022) describe as 'green extractivism', where the exploitation of natural resources is legitimized through references to the fight against climate change, while actual social and ecological impacts are neglected.

5.5.2 State-Led Decarbonization and Industrialization

The state-led energy transition and industrialization initiative represents a subordinate political project that challenges aspects of the dominant export-oriented model while still supporting GH2 development. This coalition is the least coherent both in terms of interests and actors. It is almost exclusively comprised by the labour union federation (CUT), but there are certain parts within the Ministry of Energy and CORFO that share the objectives of CUT to a certain extent. The common interest is to exploit GH2 development for domestic industrialization, the upgrading in GH2-related value chains, and to contribute to the domestic energy transition. This initiative thus stands in partial opposition to Chile's extraverted accumulation regime by advocating for a more inward-oriented development path that focuses on increased domestic value capture and long-term transformation of Chile's political economy. Concerns over the current extractive development pathway are another key motivation, as the

CUT representative articulated: "What worries us is that green hydrogen could end up like Chilean copper, where today, 78% of the wealth from copper goes abroad" (Interview 2, Pos. 8).

The initiative challenges the limited relative autonomy of the neoliberal state by calling for an expansion of state capacities and stronger state intervention. Here, CUT stands out with its demand for a leading role of state-owned enterprise ENAP. However, this initiative faces significant structural constraints, most notably the state's strategic selectivity skewed to the dominant capitalist elites' stark opposition of a stronger, more interventionist state. Further challenges stem from the extraverted accumulation regime, most notably the dependence on technological and financial capital imports and international demand. Regarding society-nature relations, this initiative promotes domestic decarbonization and industrialization over exports, potentially reducing overall environmental impact through smaller production scales and increased public planning. Nevertheless, the initiative would maintain a fundamentally instrumentalist approach to nature, albeit with more public control over resource use. This initiative thus represents a reformist approach that does not fundamentally challenge the green capitalist mode of development but seeks to reorient the accumulation regime toward domestic development needs and increased public control over the use of natural resources.

5.5.3 Social and Ecological Justice

The social and ecological justice initiative constitutes an oppositional political project that fundamentally challenges the dominant model of GH2 development in Chile. It includes social and environmental organizations, particularly those organized in the Panel Ciudadano H2 Magallanes, (parts of) indigenous communities such as the Kawésqar, critical academics, and in some aspects, elements within the Ministry of Environment and SEA. Their common objective is to limit the ecological and social impacts of large-scale GH2 development by demanding integrated environmental assessments, stronger regulations, respect for indigenous rights, and smaller-scale projects aligned with principles of social and ecological justice. This initiative directly confronts the contradictions of the dominant green-capitalist mode of development by emphasizing its ecological and social destructiveness. It challenges "green growth" narratives as mere greenwashing strategies to legitimize continued extractivist practices that maintain and deepen neocolonial patterns of resource exploitation and environmental degradation.

The initiative criticizes how the state's strategic selectivity, skewed towards the interests of business elites, systematically privileges economic interests over environmental and social concerns, as evident in the "minimal and occasional" involvement of the Ministry of Environment (Interview 5, Pos. 51). Furthermore, the initiative highlights severe injustices, such as the exclusion of indigenous communities from proper consultation. As one indigenous leader noted, "both from the central government and the regional government, the possibility of holding the consultation was denied" (Interview 7, Pos. 6-7). Regarding society-nature relations, this initiative advocates for a fundamentally different approach that puts environmental preservation over economic growth, respects the territorial rights of indigenous communities, and aims to overcome large-scale resource exploitation for global markets. Instead, it proposes more sustainable and smaller-scale alternatives that should ultimately respond to the needs and interests of local communities. By focusing on the environmental assessment process and demanding integrated evaluations that consider cumulative impacts, this initiative focuses on existing institutional pathways to contest the dominant model's ecological contradictions. However, its power remains limited compared to the resources and political influence wielded by proponents of export-oriented green capitalism.

6 Key Conflicts and Struggles

The different roles, interests and strategies of the different political initiatives regarding GH2 development materialize in specific conflicts and struggles that shape the outcomes of the policy process. These conflicts are embedded in broader contestations over the regulation of a consolidating green-capitalist mode of development in Chile. While the export-oriented green capitalism initiative currently dominates the policy process, certain aspects from counter-hegemonic initiatives have been incorporated to varying degrees, but so far without altering the overall orientation towards corporate-driven, export oriented GH2 development. This chapter analyses how power relations and conflicting social forces shape Chile's GH2 policies by examining key struggles about the accumulation regime, the regulatory role of the state, environmental regulation and international embeddedness.

6.1 Contested Accumulation Strategies and State Regulation

The conflict over GH2 accumulation dynamics and the state's role and capacity in its regulation are fundamental for defining potential GH2 development in Chile. The dominant export-oriented green capitalism initiative would maintain corporate-driven accumulation

facilitated by a neoliberal state which is characteristic for Chile's energy sector and overall extraverted, commodity-based accumulation regime. This is contested by subordinated initiatives, one aiming for state-led, introverted GH2 production for domestic industrialization and decarbonization, facilitated by an expanded role of the state, and the other for small-scale production oriented at community needs underpinned by social and ecological justice.

6.1.1 Competing Accumulation Strategies

The dominant export-oriented green capitalist accumulation strategy aims to maintain Chile's commodity-based accumulation regime by partially addressing its contradictions through ecological modernization. GH2 constitutes a central technological fix for the decarbonization of Chile's extractive sectors, especially mining, which in a decarbonizing world needs to reduce emission intensity for continued access to export markets in light of policies such as CBAM (Interview 11). Furthermore, GH2 exports would address crisis tendencies resulting from Chile's strong dependency on copper exports by further diversifying the country's export basket. As explained by a representative of the Ministry of Energy, "we see such diversification as a way to achieve greater stability both for the economy and the state" (Interview 11, Pos. 184). This is not only related to the royalties from mining exports but also to the strong concentration of FDI inflows in the mining sector, especially copper (OECD, 2023). GH2 developments would thus be an opportunity to diversify both FDI inflows to Chile and its exports.

Thus, GH2 provides a means to stabilize Chile's commodity-based accumulation regime and allow for continued resource exploitation through decarbonization and diversification, legitimized by green growth narratives. This accumulation strategy manifests in the 2020 National Green Hydrogen Strategy, which clearly prioritized exports as the main objective and domestic use focused on the country's extractive sector. While exports are the priority, both objectives are directly linked, as the government aims to "leverage our domestic base to scale into a key player in export markets" to then "expand as a global supplier of clean fuels" (Government of Chile, 2020, p. 18). As such, the strategy not only aims to stabilize contradictions in the Chilean accumulation regime but also addresses key contradictions of global green capitalism by mobilizing renewable energy resources in peripheral regions to supply the energy demands in core economies with limited production potential. Therefore, the social and ecological limits to the energy transition in the Global North would be overcome through a spatial fix, displacing production and related consequences to the Global South.

Advocates of the state-led industrialization initiative, primarily labour unions, challenge this export orientation by demanding GH2 development through state-owned companies and oriented at domestic consumption and industrialization. As articulated by the CUT representative: “What worries us is that green hydrogen could end up like Chilean copper, where today, 78% of the wealth from copper goes abroad” (Interview 2, Pos. 8). To prevent this, their alternative accumulation strategy emphasizes domestic value capture and positions the state as a central actor in economic coordination. According to the labour union representative, GH2 projects and industrial upgrading should be led by state owned companies, which would also allow for increased public control over the social and ecological implications (Interview 2). Overall, this initiative aims to use GH2 to transform the existing extraverted, commodity-based accumulation regime towards introverted productive accumulation. By transitioning from a commodity exporter to a producer of higher value-added products, the initiative hopes to overcome Chile’s subordinated position in the global division of labour.

Lastly, the ecological justice initiative presents the most fundamental challenge to the dominant commodity-based accumulation regime and the extractivist society-nature relations underpinning it. Its critique primarily focuses on the extractivist character of GH2 development and its high potential for deepening local, national and global inequalities and injustices. The initiative highlights that most of the value would be appropriated by international corporations while the massive social and ecological consequences would remain in the affected territories (Interview 5, Interview 7). This would deepen existing patterns of ecologically unequal exchange. Instead, the initiative advocates for renewable energy development at smaller scale, oriented to community needs under strong prioritization of environmental preservation over profit accumulation. In that, they challenge the overall capitalist accumulation regime and thus represent the only initiative that advocates for deeper, structural transformation.

6.1.2 Institutional Reconfiguration of State Intervention

The tensions between these competing accumulation strategies play out in struggles over the institutional form of state intervention. The dominant export-oriented initiative maintains the neoliberal, subsidiary character of the state as facilitator of private investment. This approach is evident in the 2024 Action Plan, which states that “the State must create conditions of certainty and stability, facilitate competitiveness (...) to catalyse private investment” in GH2 development (Government of Chile, 2024, pp. 74-75). State intervention is limited to public-private coordination infrastructure development, deregulation by streamlining permits and

evaluation processes, public financing to de-risk private investments, and limited financial support for technological innovation.

Counter-hegemonic initiatives advocate for more interventionist forms of state regulation, ranging from the labour union's push for state-owned enterprise leadership through ENAP (Interview 2) to civil society demands for stricter environmental governance (Interview 5). Both initiatives would transform the state's relative autonomy by expanding state capacities and strengthening public enforcement capabilities in a tightened regulation of business. By transforming the neoliberal character of the state, the initiatives aim to shift the state's strategic selectivity away from the interests of capital towards subordinated social forces. This was already a key objective of civil society actors during the Estallido Social in their demand and drafting of a new constitution that would have transformed the legal basis of the state form and thus would have facilitated a fundamental shift in the strategic selectivity of the state.

However, despite the temporal shift in the balance of power among social forces following the Estallido Social and the subsequent election of President Boric under support of subordinated social forces ultimately failed with the defeat of the new constitution. Subsequently, elements of the opposing initiatives were incorporated in the official discourse and the 2024 Green Hydrogen Action Plan. At the discursive level, the Boric government, first and foremost José Miguel Benavente, the head of CORFO, has increasingly adopted narratives of GH2-based industrialization (Interview 10). This was also evident in specific measures detailed in the action plan, such as the attraction of electrolyser manufacturing to Chile or the expansion of ENAP's role in the infrastructure and logistical development of GH2 production in Magallanes (Government of Chile, 2024). However, these modifications remained subordinated to the dominant export-oriented and corporate-driven approach. This indicates a passive revolution in which limited reforms were implemented to absorb counter-hegemonic demands without fundamentally altering the dominant power relations.

In addition to the limited relative autonomy of the state and its strategic selectivity strongly in favour of business elites, several institutional obstacles constrain the opportunities for state transformation. A representative of the Ministry of Energy argued that in recent years, debates about increased state intervention have proliferated throughout the state apparatus. However, the representative highlights that "legal barriers still significantly limit the State's capacity to act" (Interview 11, Pos. 141-154), referring to the enshrinement of the subsidiary role of the state in Chile's neoliberal constitution.

6.1.3 International Embeddedness

The struggles related to the accumulation strategies underpinning GH2 development in Chile also extend to the specific embeddedness in global markets. The dominant initiative's corporate-driven design results in competitive dynamics that favor international corporations with access to technological know-how and global financing over domestic firms. Combined with the lack of local industrial capacities and technology production, GH2 development rely almost exclusively on FDI, particularly from European firms, reproducing relations of dependency in which technologies and financial capital are controlled by core economies (Eder and Rammer, forthcoming). This systematically disadvantages local communities and smaller-scale developments that might better address local needs. The opposing state-led industrialization strategy attempts to overcome such dependency relations by advocating for greater national control over capital flows and technology development, implemented through a leading role of state-owned enterprises backed by public funds (Interview 2). Lastly, the social and ecological justice initiative promotes community-based, smaller-scale renewable energy development that is less capital intensive and would also prevent value capture by national and foreign capitalist elites.

However, several constraints arising from Chile's deep embeddedness in international markets strongly favour the dominant accumulation strategy and obstruct transformative approaches. Trade agreements strongly constrain policy options, especially regarding industrial upgrading: "Free trade agreements do not allow us to have requirements regarding the percentage of local content in any project – neither in renewables, hydrogen, nor any other sector" (Interview 14, Pos. 26-28). Furthermore, the Chilean highly open political-economic structure is strongly dependent on FDI inflows, and recent expansions relating to the lithium sector have received massive backlash from international investors. In this context, "introducing demand through quotas would be viewed very negatively (…) companies might respond by saying, 'Sorry, then we'll just go elsewhere,' and leave" (Interview 12, Pos. 91).

Chile's dependence on financial and technological capital imports for GH2 development creates various barriers obstructing opposing initiatives. The oligopsonistic structure of global hydrogen markets complicates such endeavours, as the intensive competition with other potential producers rather favour a race-to-the-bottom than a regulatory tightening (IRENA, 2022; Müller et al., 2024). Also, international lenders influence the design of de-risking mechanisms in support of a laissez-faire approach. The Chilean state's $1 billion pledge to de-risk private investment demonstrates the asymmetric power relationship, with public resources

mobilized to reduce capital's risk exposure while potential profits remain privatized (Interview 8, Interview 14). Relatedly, the state's limited budget capacities prevent it from adopting financially stimulating policies to drive industrial upgrading that could compete with the financial incentives offered by the EU or US (Interview 8). Finally, Chile's limited state capacities also contribute to the strong reliance on technical and financial assistance by GIZ that allows the development cooperation to significantly influence the policy process according to German development interests (Interview 10, Interview 12). The perhaps most significant example thereof is GIZ's decisive role in originally framing GH2 development as an opportunity to exploit the country's renewable energy potential for exports (Interview 13).

To conclude, Chile's GH2 strategy is strongly shaped by international embeddedness and results in a highly asymmetrical relationship. The dominant initiative is positioning Chile as a provider of green commodities to satisfy foreign decarbonization needs, potentially leading to a "green division of labour" that would further deepen climate injustices (Táíwò, 2022). This asymmetrical relationship is legitimized through discourses of comparative advantage and green growth, as evidenced in Minister Pardow Lorenzo's statement that Chile's advantages are "essential for Chile to become a world leader in the production of this clean fuel" (Government of Chile, 2024, p. 9). These narratives obscure the underlying power asymmetries that structure the international regime and perpetuate ecologically unequal exchange.

6.2 Environmental Regulation as Contested Terrain

Environmental assessment processes represent the most intensely contested terrain in Chile's GH2 development, particularly in Magallanes. Environmental assessment processes have become a strategic focus point of civil society actors aiming to stop dominant visions of GH2 development or at least reduce the associated implications. Business actors on the other hand have made their critique of environmental assessment a centrepiece of demands for broader environmental deregulation. These conflicts thus extend beyond GH2 development to broader struggles over environmental regulation, the outcomes of which strongly determine Chile's society-nature relations within green capitalism.

6.2.1 Environmental Assessment as a Strategic Terrain for Opposition

Civil society organizations and indigenous communities have strategically focused their opposition on the environmental assessment process. This approach exploits existing institutional mechanisms to challenge the dominant green extractivist model. Their strategy

focuses on entering citizen observations with the eventual goal of challenging possible positive evaluations at the environmental court. As explained by one interviewee:

> *"If we manage to bring down Faros del Sur, we send a message to the industry that is trying to establish itself. And the message is, 'I won't make it easy; I will make it difficult.' Investors will not want to invest in a place where there are so many problems. (...) [And] if they ignore my right, I will go to the courts."* (Interview 7, Pos. 82-87)

This strategy represents what Jessop (1990) describes as actors navigating and transforming structural conditions through strategic action. By engaging with environmental assessment procedures, opposition actors challenge the strategic selectivity of the state in a temporary and spatially focused way within institutional spaces in which environmental and social concerns could outweigh economic interests. The nearly 500 citizen observations submitted against the Faro del Sur project by HIF demonstrate this strategy in action, with indigenous communities highlighting impacts on ancestral burial sites and maritime ecosystems central to their cosmovision (Interview 7).

The strategic use of environmental assessment procedures points to the flexibility and transformability of the state apparatus and its institutional mechanisms. Rather than fixed structures, they represent dynamic terrains of struggle that actors can contest and reshape to ultimately exploit them to their advantage. As highlighted by a representative of the SEA in Magallanes, social and environmental organizations together with indigenous actors have already used this strategy to entirely stop projects like salmon farms and coal mines. Consequently, the SEA adopted a stricter approach to the evaluation process in recent years that also informs its assessment of GH2 projects. As explained by a local official:

> *"A clear stance of opposition to the industry as a whole is already emerging. This will likely manifest through citizen observations, which are then expected to reach the environmental court. I believe that's a certainty at this point. And the environmental court, as we've seen in other cases, is not passive – it's quite active and rigorous. That also motivates us to raise our own standards, because we know the environmental courts are demanding and even incorporate new bird protection criteria. So we have to anticipate and meet these standards by being strict in our evaluations"* (Interview 4, Pos. 280).

Thus, past and current struggles led by civil society organizations and indigenous communities have already shown success. This is also evident in the significant delays in the assessment of HIF's Faro del Sur project, which is still pending (Interview 3). In its response to HIF's initial impact study, the SEA demanded several improvements, such as the creation of a safety system for hazardous materials or the expansion of protection mechanisms for birds (Amplían Plazo de Respuestas a Observaciones Para Planta de Combustibles Carbono Neutral Cabo Negro de Hif, 2025). HIF subsequently requested two deadline expansions for its revised study, delaying the evaluation process by almost a year. Thus, a temporal disruption of GH2 project development was achieved. Furthermore, the possibility of appealing to environmental courts, where the social and ecological protection is favored over business interests, represents another promising mechanism to challenge the dominant accumulation strategy for GH2 development.

6.2.2 Contested Environmental Reforms

The government's proposed reforms to environmental framework law 19.300 and sectoral permit processing represent attempts to reconfigure existing environmental regulation to facilitate green capitalist accumulation. Although civil society organizations have long demanded a reform of the framework law to address shortcomings in environmental regulation, the content of the proposed reforms is apparently strongly influenced by business pressures (Castellanos, 2024). In the last years, business actors have continuously pushed for roll-backs of the country's moderate improvements of environmental regulation in the late 2000s and early 2010s (Interview 10). This is evident in demands for an acceleration and easing of permit processes by the head of H2Chile, Marcos Kulka, in October 2023, reiterating earlier calls by Marko Razmilic, the head of Antofagasta's mining association AIA. A Chilean researcher argues that these demands are:

> *"part of a broader conflict, a larger debate that you've probably come across, around what some are calling* permisología*. That term has become fully embedded in the discourse and is very much part of the current extractivist push. It plays a central role in hydrogen development, especially when it comes to how these projects will be evaluated and whether their implementation will, in some way, be made easier or fast-tracked."* (Interview 10, Pos. 20)

In addition to business actors, international organizations also strongly promoted these institutional changes. The OECD's December 2024 economic outlook recommended that Chile "streamline regulatory processes are crucial to spur entrepreneurship and attract investment, particularly in sectors connected to the green transition" (OECD, 2024, p. 123). Similarly, GIZ cooperation with the Ministry of Energy on regulatory aspects of GH2 development was also aimed at the "reduction of processing times" (Interview 13, Pos. 86). Shortly after that, in January 2024, the government presented the reform proposals which would accelerate the assessment processes to reduce evaluation times by 24%, would abolish political authority over evaluation outcomes in favour of technocratic decision-making, and create exceptional urgency procedures for projects deemed extraordinarily important (Maldonado Caballero, 2024). These changes would effectively restructure state-nature relations by facilitating faster and easier approvals of projects and complicating opportunities for contestation.

Civil society resistance to these reforms highlights the inherent conflict between capital accumulation imperatives and ecological implications. In a declaration from August 2024, 232 civil society actors – including social, environmental and indigenous groups and organizations – criticized the government for yielding "to the proposals of think tanks close to economic interests (...) [while] the views of environmental organizations, unions, and citizens who expect environmental regulations that protect them (...) have been disregarded" (Declaración Pública, 2024). In a later declaration, they criticized the reforms as a chainsaw-approach for massive environmental deregulation, highlighting that the reforms would weaken water and health regulations, allow sworn statements by developers to replace certain permits, and exclude civil society from the legal process (Declaración Pública, 2025). A central criticism also referred to the newly established fast-track procedures for projects of high importance. Civil society organizations thus concluded that "In a state already weak in enforcing regulations on economic activities, this bill promotes deregulation in favour of project owners rather than reinforcing oversight" (ibid.).

Although the bills are not yet adopted, civil society actors maintain that their content had further deteriorated during the legislative process, again demonstrating that the state's strategic selectivity is strongly in favour of capital interests. Still, this conflict over environmental regulation highlights the fundamental contradiction of green-capitalist accumulation: the attempt to stabilize infinite accumulation within finite biophysical limits (Brand et al., 2024). The institutional reconfiguration proposed through environmental reforms aims to temporarily displace this contradiction by accelerating project approvals and limiting spaces for

contestation. However, this approach merely shifts environmental contradictions spatially (to affected territories) and temporally (to future generations) without resolving the underlying incompatibility between capital's expansionary logic and ecological limits.

6.3 Central Contradictions and Hegemonic Struggles

The conflicts surrounding Chile's GH2 policy process reveal several central contradictions of the green-capitalist mode of development that inform the sector's development. First, the contradiction between capital accumulation imperatives and ecological limits materializes in tensions between the large scale of projects required for profitable production and the resultant aggravation of environmental impacts. This contradiction is temporarily displaced through environmental reforms that accelerate approval processes while reducing spaces for contestation, and spatially by shifting the consequences to local communities. Second, the contradiction between regulation and accumulation, evident in the struggle between achieving necessary political legitimacy by addressing civil society interests and the accumulation interests of dominant business elites. Despite rhetorical commitments to inclusion, the involvement of community needs remains "purely cosmetic" according to civil society representatives (Interview 5, Pos. 30). Finally, the fundamental contradiction of green capitalism – the attempt to resolve ecological crises through the same market mechanisms that produced them – underlies the entire GH2 policy process. This contradiction manifests in that the strategic selectivity of the state persistently privileges exchange value (i.e., profitable production) over use value (i.e. community needs and ecological sustainability).

Broader hegemonic struggles over Chile's mode of development determine how these deeper contradictions are processed. The conflicts discussed are thus also a materialization of these broader hegemonic struggles. Following the Estallido Social, a counter-hegemonic project centring around improving social and ecological justice emerged, which culminated in the highly ambitious, emancipatory design of the first draft for a new constitution. However, the defeat of the constitutional reform draft and with it, the disintegration of the counter-hegemonic project, rapidly closed the window of opportunity for long-term transformation of the state and its strategic selectivity. This is evident in the Boric' government's accommodation of corporate-driven green capitalism through environmental deregulation and public de-risking, despite initial environmentalist discourse. The substantial environmental reforms should however also be understood as a response to the effectiveness of opposition strategies utilizing existing mechanisms in the evaluation process.

The consequence is a contested process of passive revolution whereby elements of counter-hegemonic demands are apparently incorporated and opposition is silenced so that power relations or accumulation patterns are maintained. This is evident in increased references to local community needs and green industrialization in the 2024 Action Plan, coupled with minimal changes in policy approaches. By framing GH2 as simultaneously addressing climate change, economic development, and social inclusion, the dominant political initiative attempts to stabilize a hegemonic project that maintains Chile's extraverted accumulation regime while neutralizing opposition through limited concessions and narratives of “green” growth. Nevertheless, the persistent conflicts around environmental assessment, state intervention, and community participation reveal the contradictions and overall instability of green capitalist hegemony.

7 Conclusion

This thesis has examined the contested GH2 development in Chile through a critical political economy lens, analysing how conflicting actor interests and the specific political-economic context shape the related policy process. The three research questions investigated the political-economic context in which GH2 development emerges; the roles, strategies, and interests of domestic and international actors; and how these conflicting interests materialize in concrete struggles that shape Chile's GH2 policy process.

7.1 Political-Economic Context

The analysis reveals that Chile's GH2 development is fundamentally shaped by a neoliberal state with limited relative autonomy and an extraverted, commodity-based accumulation regime. The foundations for these structural configurations were laid during the brutal neoliberal counterrevolution under Dictator Pinochet and the subsequent restructuring of the state and economy. The disintegration of the state was accompanied by a shift in political power from civil society forces to capitalist elites, dominated by few domestic conglomerates and transnational corporations. These groups drove rapid extractivist accumulation expansion, imposing extractivist society-nature relations through violent oppression of civil dissent. This political-economic structure in which the strategic selectivity of the state is skewed towards the interests of a few business elites that rely on commodity extraction for exports is maintained until today.

In the first passive revolution during the democratic transition, high-level negotiations between political and capitalist elites ensured the consolidation of power relations through the marginalization of emancipatory actors. A similar transformation occurred in response to the broad protests led by social and environmental movements in opposition to hydropower expansion and the neoliberal, extractivist politics. The responding green-capitalist reforms led to a rapid expansion of renewable energy to stabilize the commodity-based accumulation regime. The Estallido Social and the resulting constitutional process opened a small window of opportunity for shifting the strategic selectivity away from capitalist forces. However, a third passive revolution was achieved through the defeat of the new constitution and the economic policies of Boric that consolidated the green-capitalist mode of development.

Thus, from Pinochet's violent neoliberal restructuring to the more recent consolidation of green-capitalist hegemony, powerful elites have maintained control over the state apparatus and

capitalist accumulation through processes of passive revolution. As a result, GH2 development in Chile, aimed at the diversification of commodity exports and decarbonization of extractive sectors, represents a continuity and potential deepening of the country's commodity-based accumulation. The fundamental inequalities and contradictions resulting from these extractivist society-nature relations are now stabilized in a green-capitalist mode of development.

This process was strongly embedded in developments at the global level, which saw the formation of a green-capitalist hegemony project starting in the late 2000s and initiated by political and capitalist elites in the Global North. This hegemony project relies on ecological modernization strategies to process both the ecological crisis and the crisis of globalized neoliberal accumulation, that however do not overcome fundamental contradictions nor challenge dominant power structures. As such, green-capitalist strategies require a combination of fixes, including the intensification of ecologically unequal exchange, regulated by what Bringel and Svampa (2024) describe as a "decarbonization consensus". The development of global GH2 markets constitutes a technological fix for the ecological modernization of capitalism. The emerging global GH2 market structure is characterized by oligopsony, capital-intensity, high uncertainty, and the dominant role of states and corporations from the Global North. These conditions threaten a potential race-to-the-bottom among producer countries and a related deepening of ecologically unequal exchange.

Ultimately, the context analysis reveals that several policy objectives, manifest in the 2020 GH2 strategy, are strongly shaped by existing structural factors. Chile's highly extraverted, commodity-based accumulation regime and limited relative autonomy creates structural constraints that demand political and capitalist elites to strongly respond to developments in the global capitalist accumulation regime. The shift towards green capitalism at the global level increased the attractiveness of investments in and trade with renewable energy and introduced decarbonization requirements, contributing to a corporate-driven national GH2 strategy that aims to attract FDI and caters strongly to the needs of domestic extractive sectors and foreign demand. Furthermore, the lack of state capacities and the strategic selectivity dominated by business interests explains the laissez-faire approach of the strategy and indicates that community needs are subordinated to business interests.

7.2 Actor Analysis

Nevertheless, GH2 development and the structural conditions within it emerges are shaped by conflicting actor interests, clashing within a contested policy process. Within state

institutions, the Ministry of Energy and CORFO emerge as key drivers of GH2 development, with the former focused on strategic planning and the latter on implementation and productive development. International actors, particularly the German development agency GIZ, have exercised decisive influence in shaping Chile's export-oriented GH2 pathway. Meanwhile, civil society opposition, concentrated in the Magallanes region where communities face significant impacts from proposed large-scale projects, is representing the most substantial challenge of the dominant, export-oriented strategy.

Based on an analysis of the key roles, interests and strategies of the central actors involved, the actor analysis identified three competing political initiatives with divergent visions for GH2 development in Chile: First, the export-oriented green capitalism initiative, led by state actors, international capital, business associations, international institutions and foreign state agencies, pursues large-scale, export-oriented GH2 production. This dominant initiative seeks to stabilize Chile's commodity-based accumulation regime through decarbonization and diversification, legitimized by green growth narratives.

Second, the competing state-led energy transition and industrialization initiative, championed primarily by labour unions, advocates for domestic industrialization and value capture through increased state intervention and public control over GH2 development. Third, the social and ecological justice initiative, representing an oppositional project led by social and environmental organizations, indigenous communities, and critical academics, fundamentally challenges large-scale GH2 development by demanding integrated environmental assessments, respect for indigenous rights, and smaller-scale projects aligned with social and ecological justice principles.

7.3 Policy Struggles and Capitalist Contradictions

These competing political initiatives materialize in concrete struggles over the configuration of GH2 development that connect to the overall regulation of a consolidating green-capitalist mode of development in Chile. Key conflicts are underpinned by struggles over the strategic selectivity of the state and centre around the accumulation regime, the form and extent of international embeddedness and the environmental regulation of GH2 development. These conflicts reveal three central contradictions: the tension between capital accumulation and ecological limits; the conflict between regulation for social legitimacy and business interests; and the fundamental paradox of addressing ecological crises through market mechanisms.

Regarding the accumulation regime, the dominant initiative promotes an extraverted, export-oriented development model that serves as a spatial fix for global green capitalism by displacing energy production and related ecological consequences to the Global South. Both counter-hegemonic initiatives challenge this by advocating for introverted accumulation focused on domestic needs, but with different strategies and objectives. The state-led initiative highlights the importance of value capture through a leading role of state-owned enterprises in GH2 development. While this would increase public control to a certain extent, it presents a less fundamental challenge to the underlying accumulation dynamics and extractivist-society nature relations. The social and ecological justice initiative instead strongly challenges the existing power relations and accumulation regime by expanding community control and increasing ecological protection. The transformative potential of this initiative, however, goes beyond its objectives related to GH2 and extends to the movement itself, as its contestation connects to broader hegemonic struggles.

Strongly related are struggles surrounding the form and extent of the international embeddedness of GH2 developments in Chile. Chile's dependency on FDI, technology transfers, and export markets create structural constraints that strongly inform the dominant initiative's export-oriented and highly internationalized development. This is materializing in the state's $1 billion pledge to de-risk private investment while potential profits remain privatized. However, contestations by the competing initiatives would reduce the reliance on FDI and export markets through a stronger inward orientation. Especially in relation to the social and ecological justice initiative, the community-orientation and the resulting small scale of potential project would require less capital-intensity. Combined with designs like community-owned, decentralized energy systems, this would not only reduce international dependencies but also contribute to community emancipation.

The environmental assessment process has emerged as strategic battleground for civil society opposition to challenge the dominant initiative and its underlying extractivist society-nature relations. The SEA and the environmental courts represent institutional spaces where environmental and social concerns can potentially outweigh economic interests, which the opposing social and environmental actors and indigenous communities exploit to mitigate risks, slow-down or stop GH2 development. This struggle demonstrates how specific conflicts connect to broader contradictions within capitalism, in this case between the accumulation imperative and the ecological limits. In response to this potentially highly effective challenge, business actors, supported by international actors, have mounted a campaign for environmental

deregulation to eventually limit spaces for contestations. This would not only be decisive for the success of GH2 developments as envisaged by the dominant initiative, but also further stabilize the green-capitalist mode of development. Unsurprisingly considering the state's strategic selectivity in favour of capitalist elites, the government's reform proposals are strongly privileging business interests over social and environmental concerns and have been strongly criticized by civil society actors.

7.4 Contribution and Outlook

This thesis contributes to a growing body of critical social science research investigating aspects of contested processes surrounding the social-ecological transformation of capitalism. As argued by Brand et al. (2024), it is essential for critical scholarship "to examine the constantly transforming dynamics of capitalism in and through its contradictions" (p. 167) and thereby shed light on emancipatory struggles and the barriers and challenges they confront. To that end, Pichler (2023) highlighted the importance of analysing concrete conflicts to gain insights into the interplay between structure and agency in the broader transformation of capitalist societies. This thesis contributed to such research by demonstrating how contradictions of currently dominant ecological modernization strategies materially manifest in conflicts around GH2 developments in Chile. A close investigation of the context and conflicting actor interests revealed how emancipatory contestations of the dominant strategy are shaped and constrained by existing power relations and structures at multiple levels.

Furthermore, this thesis and its limitations also contribute to the increased application of historical-materialist policy analysis for investigating social-ecological transformation conflicts. Within the framework of this thesis, HMPA has proven a valuable methodological framework for investigating how contested policy processes, embedded in power relations and structural conditions, shape GH2 development in Chile – rather than technical or economic factors alone. Lastly, as highlighted in the introduction, critical scholarship on emerging GH2 developments is growing, but still limited, and this research contributed to this growing literature by critically investigating the still under-explored case of Chile. Furthermore, the thesis establishes a sound basis for further research on GH2 developments and social-ecological transformation conflicts in Chile.

The findings of this paper demonstrate that the design and implementation of GH2 development is strongly dominated by the interests of domestic and foreign capital and international actors while the perspectives of civil society organizations and labour unions are

sidelined. In its current form, GH2 development forms a central technological fix to both the ecological modernization of Chile's commodity-based accumulation regime and, as a spatial fix, also for ecological modernization in the Global North. As such, GH2 development along the lines of green capitalism represents not a resolution but a displacement of key contradictions, stabilized by narratives of decarbonization and green growth.

Despite official framings of GH2 as simultaneously addressing climate change, economic development, and social inclusion, persistent conflicts reveal the inherent contradictions and instability of green capitalist hegemony in Chile. However, the ongoing contestation of GH2 development pathways by subordinated social forces upholds the potential for emancipatory socio-ecological transformation, despite facing severe structural challenges. This research aimed to contribute to emancipatory challenges through a detailed exploration of the existing power structures and interests that enable and hinder transformative change. The dynamic nature of these developments might open new opportunities, such as a closer cooperation between civil society organizations and labour unions in challenging the dominant initiative. Such potentials and the challenges they confront represent highly relevant topics for further research. As GH2 projects move from planning to implementation stages, future critical research is of central importance and should track the development of conflicts and power dynamics to identify possibilities for to push counter-hegemonic alternatives. In light of Chile's strong embeddedness in global developments, this must also mean to investigate ways to challenge the power relations and interests in the Global North that strongly shape green-capitalist GH2 development in Chile.

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Appendix

List of Interviews:

Interview 1 with Austrian investor and GH2 project developer in Magallanes (Vienna, 22/05/2024)

Interview 2 with representative of the Chilean labour union federation (Santiago, 04/09/2024)

Interview 3 with representative of ENAP (Punta Arenas, 09/09/2024)

Interview 4 with representative of the environmental assessment agency SEA (Punta Arenas, 12/09/2024)

Interview 5 with representative of a local civil society organization that is part of the Panel Ciudadano H2 Magallanes (Puerto Natales, 13/09/2024)

Interview 6 with representative of CORFO Magallanes (Punta Arenas, 16/09/2024)

Interview 7 with indigenous community leader (Punta Arenas, 17/09/2024)

Interview 8 with employee of EU-based Energy Corporation developing GH2 projects in Chile (Santiago, 23/09/2024)

Interview 9 with representative of Chilean agency for export promotion ProChile (Santiago, 24/09/2024)

Interview 10 with social science researcher of energy topics at the University of Chile (Santiago, 25/09/2024)

Interview 11 with employee of Chile's Ministry of Energy (Santiago, 26/09/2024)

Interview 12 with representative of international hydrogen consultancy (Santiago, 26/09/2024)

Interview 13 with coordinator at GIZ (Santiago, 27/09/2024)

Interview 14 with high-level member of the CORFO-led Green Hydrogen Development Committee (Online, 04/10/2024)

Interview 15 with representative of the World Bank (Online, 07/10/2024)