Decoding India's Green Hydrogen Discourse

A Discourse Network Analysis of Green Hydrogen Stakeholder Perspectives in India

Master Thesis for the Management of Technology Program

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Preface

This thesis is the result of my Master's research conducted at Delft University of Technology, and it reflects both an academic inquiry and a personal journey into the intersections of energy transition, technology discourse, and policy analysis. The work specifically focuses on the discourse surrounding green hydrogen in India, a subject that has gained significant traction in recent years due to its potential role in decarbonising hard-to-abate sectors and reshaping national energy strategies.

The motivation to explore this topic stemmed from a broader interest in how emerging technologies are not only developed and deployed, but also discussed, debated, and legitimized in the public domain. In a country as complex and ambitious as India, the green hydrogen narrative is shaped by a wide array of actors: g overnments, industries, researchers, and civil society, all of whom bring unique expectations, concerns, and framings to the table. This thesis seeks to understand those narratives through the lens of Discourse Network Analysis, providing both a methodological and empirical contribution to the study of energy transitions.

This work would not have been possible without the support and encouragement of many individuals. I am deeply grateful to my first supervisor, Dr Nihit Goyal and Chair and Second Supervisor, Dr Amineh Ghorbani along with the External Advisor on this thesis, Dr Mario Angst for their guidance, critical feedback, and consistent encouragement throughout the research process. I would also like to thank them for their insights and expertise. I am thankful to my peers and friends, whose discussions and perspectives helped sharpen my thinking at various stages. Lastly, I extend heartfelt gratitude to my family for their unwavering support and belief in my academic journey.

I hope this thesis contributes meaningfully to the understanding of India's hydrogen discourse and serves as a stepping stone for future research in this rapidly evolving field.

Executive Summary

In recent years, India has taken up an ambitious goal to reach net-zero emissions by year 2070 and position itself as a global exporter of green hydrogen. The launch of the National Green Hydrogen Mission in 2023 further solidifies the potential of the gas, which is produced through purely renewable sources, to decarbonise the hard-to-abate industries. Nevertheless, the adoption of green hydrogen in India brings forth concerns related to social acceptance and public opinions of the transition. While most stakeholders show support for the green hydrogen transition, multiple perspectives about the technical feasibility, potential use cases and production pathways can also be seen. This difference in opinions creates a possibility where there is a misalignment between the national goals and the national needs in terms of economic scale and energy security. In order to create and implement a national strategy that reflects the priorities of the nation, understanding stakeholder perspectives is necessary. By identifying coalitions and conflicts between the stakeholders in the discourse, the thesis aims to address the fault lines, so that smarter, conflict-aware policies can be devised by the authorities.

Using the methodology of Discourse Network Analysis (DNA), the thesis explored the Indian hydrogen discourse using newspaper articles as the primary data source for stakeholder statements. The study identifies 149 actors that talk about different concepts, which form one of the core tenets of the research. The statements made by the actors are categorized into seven key concepts and the shifts in the priority are tracked over four temporal phases in which the timeframe of the study is divided. The discourse was marked by a steady prominence shown by actors from the energy sector and policymakers who advocate for policy improvements, highlight their conflicts on India's current policy for green hydrogen, debate about the production pathway (exclusively green or non-green integration) and technical aspects of green hydrogen. The evolution of the discourse undergoes four policy-anchored phases with the debate around green hydrogen increasing in complexity across each phase. The most central actor in the discourse is Ministry of New and Renewable energy with varying degrees of centrality across the phases. In terms of contestation, the most divergence in opinions can be seen in the 3rd Phase but decreases in the 4th Phase with key reflections and analysis on the same.

By focusing on the narratives placed by the involved stakeholders, DNA allows for understanding the dynamics that actively shape socio-technical transitions. By consolidating the perspectives of different actor groups such as policymakers, researchers, energy and industry actors, DNA brings all the opinions of the involved stakeholders under a single analytical level and with it makes room for the temporal evolution of priorities and perspectives. Moreover, it reveals the network architecture of influence. DNA turns text into networks so that both the dominant actors and the marginal voices can be placed on the same level of consideration, which is in turn useful for engagement strategies and policies inclusive on all levels of society affected or directly linked to such transitions.

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Nomenclature

Abbreviation	Full Form
DNA	Discourse Network Analysis
NHM	National Hydrogen Mission
NGHM	National Green Hydrogen Mission
GH2	Green Hydrogen
PEM	Proton Exchange Membrane
RE	Renewable Energy
RPO	Renewable Purchase Obligation
PLI	Production Linked Incentive
FM	Finance Minister
MoT	Management of Technology
MNRE	Ministry of New and Renewable Energy
PSU	Public Sector Undertaking
CGD	City Gas Distribution
LNG	Liquefied Natural Gas
JV	Joint Venture
SNA	Social Network Analysis
SIGHT	Strategic Interventions for Green Hydrogen Transition
IEA	International Energy Agency
IRENA	International Renewable Energy Agency
IIT	Indian Institute of Technology
EU	European Union
UN	United Nations
MoU	Memorandum of Understanding
PPA	Power Purchase Agreement

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Introduction

1.1. Background and Context

Rampant concerns about climate change and energy crisis have globally started the discussions for alternative fuels to meet the demands of an energy-intensive world that we are living in today. With the global energy landscape dealing with these issues, there is an urgent need to reduce the economy's reliance on fossil fuels and, reduce the associated costs of energy generation using non-renewable sources of energy (Maka & Mehmood, 2024). Moreover, limited reserves of fossil fuels calls for a profound transition towards sustainability and decarbonizing the energy landscape (Moriarty & Honnery, 2009).

Across the globe, there is a strong consensus for the use of hydrogen as the fuel for the next generation that can lead the world towards a decarbonized economy (Maka & Mehmood, 2024). Hydrogen as a fuel presents a potential to satisfy approximately 24% of the global energy needs and abate 60 gigatons of greenhouse gas emissions (Jayachandran et al., 2024). Moreover, it has extensive applications of reducing carbon emissions in industries like steelmaking, transport, chemicals, which are significant contributors of emissions (Superchi et al., 2023).

There are various colours assigned to the type of production of hydrogen, which are attributed to the processes and methods involved in the production of hydrogen. Green hydrogen, which is produced from renewable sources of energy, emerges as the form of fuel with negligible carbon emission during the lifecycle (Maka & Mehmood, 2024). Green hydrogen is produced by implementing the process of electrolysis, by passing an electric current through water. This splits the water molecule into hydrogen and oxygen, giving a clean way of production of hydrogen without any greenhouse emissions being released in the process. In addition to the net-zero value that green hydrogen provides, it has a light-weight nature, a high mass energy density and a relatively straightforward electrochemical conversion process. This allows for ease of transportation of energy across pipelines as well as in the liquid form (Oliveira et al., 2021).

Along with concerns related to replacing fossil-fuels with renewable sources of energy,

there are also concerns related to public acceptance, policy, and stakeholder management that comes with the energy transition (Owusu & Asumadu-Sarkodie, 2016). Green hydrogen, even though a promising candidate brings with it challenges such as high costs, infrastructure gaps, and lower energy efficiency (Jayachandran et al., 2024). Furthermore, the challenges faced in terms of adoption need to be addressed by governemnts. Policies are crucial to inform public acceptance of the renewable source of energy (Islam et al., 2024). For a well-defined strategy for policy implementation, it is hence necessary to create specific benchmarks for production, distribution and mandated utilization, requiring a strong coordination sense between the involved stakeholders of the value chain (Islam et al., 2024)

India, congruent to other nations heavily involved in the mitigation of climate change, is actively pursuing green hydrogen as a sustainable energy solution to reduce fossil fuel dependency and achieve its goal of net-zero emissions by 2070 (Sambasivam & Sarma, 2024). The country has put forth its National Green Hydrogen Mission which aims to establish a production capacity of 5 MMT per year and develop 60-100 GW of electrolyser capacity (Sambasivam & Sarma, 2024). India, due to its favourable geographical conditions, with abundant renewable energy sources and coastal areas, make it well-suited for green hydrogen production (A. Sharma et al., 2023). Within the country, states like Gujarat, Andhra Pradesh, and Tamil Nadu have been identified as ”renewable energy clusters” for piloting green hydrogen projects (A. Sharma et al., 2023). The initial projects for implementing green hydrogen in the country are being undertaken in sectors such as shipping, long-haul mobility and the steel industry (Sambasivam & Sarma, 2024).

The development of green hydrogen is gaining momentum in global energy transition strategies to significantly reduce greenhouse gas emissions (Noussan et al., 2020). In transition cases, understanding stakeholder perspectives is crucial for effective policy implementation. Successful implementation requires involving a wide range of stakeholders, especially implementing actors, at all stages of policy development. Stakeholder engagement helps identify potential pathways for niche empowerment, such as information campaigns, collaborations, and incentives (Falcone, 2018). Nevertheless, defining stakeholders and characterizing them is a significant challenge due to various approaches regarding production methods, emission thresholds, etc (Velazquez Abad & Dodds, 2020). While the stakeholder perceptions favour renewable sources over non-renewable ones, and green hydrogen providing enhanced energy security for local industries, its implementation faces technical, economic and geopolitical challenges (Parente et al., 2024) (Noussan et al., 2020). Hence, to foster international cooperation, countries would need to address stakeholder issues on a local level. Concerns regarding limited public engagement exist in the decision-making processes which need to be addressed by understanding the stances of involved actors to deliver social acceptance of green hydrogen technologies. (Parente et al., 2024).

1.2. Problem Statement

Köhler et al., 2019 argues that sustainability challenges such as climate change warrant for fundamental changes in the socio-technical systems. Transitions of this nature are not only a technical and economic challenge but also fundamentally social and po-

litical, with multi-level changes (Patwardhan et al., 2012). These multi-level changes involve experiments and changes in technology regimes and require addressing socio-political issues for equitable implementation, which include analysis of institutional dynamics and the distribution of power structures (Patwardhan et al., 2012; Lockwood et al., 2016). Changes in status quo, do not simply enter society but are rather framed, debated, and legitmised through discourse, where actors frame and interpret issues forming discourse coalitions and understand the storylines that influence policy outcomes (Markard et al., 2021).

Different actors hold differing interests, values and agendas in a transition. While governments may emphasise national energy security, actors from the industry may highlight economic opportunity and actors from the NGOs or civil society highlight environmental feasibility (Leifeld, 2020; Jesse et al., 2024). These actors do not just highlight perspectives, but actively shape narratives in the society that justify certain choices and marginalise others (Cotton, 2015). Therefore, by mapping these stakeholder perspectives the dominant actors can be identified. Moreover, the study also aims to focus on how particular concepts gain traction and how the perspectives of the actors on these concepts evolve over time, allowing a more transparent understanding of the focus of Indian actors for the energy transition.

Due to green hydrogen production technology being still being in the nascent stages of mass diffusion, it is important to consider the perspectives of key stakeholders which will reveal the multi-actor conflicts that would need to be addressed (Ohlendorf et al., 2023). Adding on to the stakeholders, their stance on market conditions, governmental regulation, technical risks and infrastructure would also have to be considered (Jesse et al., 2024) for an effective policy implementation. Understanding these aspects of the discourse is therefore a practical necessity to evaluate the direction, the degree of inclusivity and progress of India's green hydrogen transition.

1.3. Research Objective

While it is understood that studying the green hydrogen is necessary, most of the existing literature focuses on the European contexts. These studies highlight the competing narratives of the hydrogen's future in these countries, including conflicts over production methods, sectoral applications and investment pathways (Ohlendorf et al., 2023), which seems to be missing for India. Moreover, the context of India differs from Europe on various institutional, economical, and social conditions levels (Odeh, 2010). Addressing this gap is essential for understanding the energy transition in centralised, emerging-economy contexts. It can be expected that based on the different contexts, the narratives may consolidate differently than in mature democracies as the ones in Western Europe.

The initial discussion about the problem reveals that it is important to know the key actor stances of green hydrogen, for its effective, value-driven implementation in the industry. By understanding the key actor stances we understand how exactly the underlying multi-actor and multi-sector conflicts, giving a much clearer idea about the inter-dependencies of these actors and their optimism or skepticism about green hydrogen as a potential energy source. (Köhler et al., 2019). Through this research,

we aim to find out the stances of key actors in the green hydrogen transition in India and how the key actor stances on economic development affect the stances of actors on green hydrogen transition. We aim to do this by conducting a qualitative coding analysis on the direct quotes specified by the key actors in the discourse. By undertaking this research we aim to contribute towards driving the policy narratives for the development of green hydrogen technology and understand whether the general public discourse towards green hydrogen is optimistic or skeptical.

On a global level, policymakers are pushing green hydrogen as an alternative energy carrier and for applications in industrial usage ((IEA), 2023). The involved stakeholders further provide their opinions and shape narratives along new technologies as part of pushing their vested interest in the new technology (Hajer, 2006). These opinions further solidify in the form of public perception, which then further becomes hardened in terms of policy. Once these perspectives of stakeholders are strengthened in society, the marginal voices in the discourse may tend to get disregarded which hurt the national strategic interests in the long run (Hajer, 1993).

In India, understanding the evolving narratives surrounding green hydrogen is imperative, particularly as diverse actors, governments, industries, and civil society, form distinct coalitions and engage in contestations. By examining these actor stances, this study seeks to illuminate how varying perspectives on economic development, production methods, and infrastructure readiness shape the policy discourse and its trajectory (Odenweller et al., 2022; Jesse et al., 2024). Through the application of discourse network analysis, the research will map the alignments and conflicts among these stakeholders, providing critical insights into the factors contributing to the slow implementation of green hydrogen in India (Markard et al., 2021).

1.4. Knowledge Gap & Research Questions

The evidence base for India's green-hydrogen transition is geographically and thematically skewed: most stakeholder/discourse studies are Europe-centric and not cleanly transferable to India, where energy-security and export priorities differ from EU decarbonization. Within India, a few number of studies track how narratives and coalitions reconfigure across policy milestones. A lack systematic mapping of actor interactions can also be seen as media discourse studies are not conducted in the context of India for energy transitions. This bias sustains broad, techno-optimistic storylines ("exclusively green") that clash with more modest 2030 goals set by the nation, given the technical efficiency of green hydrogen. Consequently, there is a gap in context-fit analyses that link India's evolving discourse to concrete instrument design (subsidies, standards, offtake) and state-specific implementation pathways.

The insights derived from the conducted literature review, which is analysed in further detail in 2 gives rise to our primary research questions which would be focused on understanding the stances of the key stakeholders in the green hydrogen transition in India. The research will build upon this base and also aim to answer questions such as the key issues regarding green hydrogen in India, stances of actors involved and reveal discourse coalitions and conflicts.

"How has the discourse of hydrogen evolved among the Indian actors since 2020?"

The research question above will be the focus of the study. By addressing this primary research question we will explore the stances of incumbent actors as well as indirectly connected stakeholders in the green hydrogen transition. We will start off by identifying the key issues in the green hydrogen transition in India, followed by identification of the key actors involved in the green hydrogen initiatives and what are their stances on international collaboration on the research and development for green hydrogen technologies.

1.4.1. Sub-Research Questions

1. What are the phases that the Indian green hydrogen discourse can be divided into?
2. What are the key concepts discussed in the mainstream media regarding green hydrogen in India?
3. Who are the key actors involved in green hydrogen initiatives in India?
4. What are the stances of the key actors involved in green hydrogen initiatives in India?
5. How do actors interact within the discourse network?

1.5. Relevance to MoT

The research objective provided highlights a close alignment with MSc Management of Technology program. The interdisciplinary nature of the program reflects the research objective. The course emphasizes managing technological innovation, strategic management, entrepreneurship and stakeholder analysis. The research on green hydrogen discourse in India directly resonates with these themes by investigating how stakeholders frame, discuss and strategize around a significant technological innovation which is green hydrogen in our case.

The thesis focus on stakeholder perspectives in technology transitions closely relates to the one of the objectives of the MoT course which is analysing current and future scenarios of the society from a technological, economical and social perspective. The curriculum places a strong emphasis on technology management from a well-rounded lens. Further, the methodology that is expected to be employed for the research aligns with the rigorous qualitative approaches to research taught in the 'Research Methods' course.

Furthermore, the thesis demonstrates strong alignment with MoT's focus on real-world applicability and policy implications. The practical insights derived such as the necessity for subsidies, institutional coordination, and clarity in technological readiness are directly relevant to policy-making bodies. These insights highlight MoT's emphasis on translating academic research into actionable recommendations for stakeholders and

policymakers.

2

Literature Review

This thesis aims to derive the vision and theoretical frame and background context of the study through a literature review. The literature review helps to provide an overview of existing research and the theoretical and methodological approaches used in existing research. Furthermore, it guides the development of the analysis of the results that are received in similar studies.

The rapid escalation of global decarbonization commitments has increased stakeholder interests in alternative fuel carriers capable of integrating with existing energy infrastructures (Kumar et al., 2024). Multiple studies have cited green hydrogen as a promising alternative energy solution to combat the ever-increasing scarcity of fossil fuels (Hosseini & Wahid, 2016; Schlund et al., 2022; Harichandan et al., 2023; Marouani et al., 2023; Islam et al., 2024). However, current economies of scale, transportation infrastructure and cost-effectiveness of green hydrogen poses challenges to the large-scale adoption of green hydrogen (Ma et al., 2024). Furthermore, policy uncertainties significantly impact the large-scale adoption. Odenweller et al., 2022 further states that despite the potential of green hydrogen for decarbonization, the supply is likely to remain uncertain for the short term as well as long-term decarbonization goals.

2.1. Technical Knowledge

Recent research in the field of green hydrogen highlights the advancements in the technological feasibility of the production methods. Water electrolysis emerges as the most promising methods of green hydrogen production, with a prominence given to alkaline and proton exchange membrane (PEM) electrolyzers (Vidas & Castro, 2021; Shiva Kumar & Lim, 2022; Hassan et al., 2024).Vidas and Castro, 2021 in their state-of-the-art review of hydrogen production technologies specify some recent developments and advancement in the water electrolysis methods.Barbir, 2005 finds that the PEM electrolyzer are simpler than conventional alkaline electrolyzers, and require very little power consumption to generate hydrogen at pressures up to 200 bar. Joy et al., 2018 in their study, focus on the use of nanomaterials for photochemical water splitting. The method mentioned in the study is found to be easier, cheaper and more sustainable for generating hydrogen by coupling solar energy. Nevertheless, the study

remains ineffective for scale-up due to inefficiencies in the technology. The higher cost of nanomaterials required for the process does not align with the economies of scale of green hydrogen production. In a more recent review study by Grigoriev et al., 2020, the authors find that the current level of research and technology readiness of each method of production is at different stages. The authors also find that the other methods of production such as PEM have still not reached the scale-up level that alkaline water electrolysis has been at since decades. This is a point of conflict to consider as earlier research mentioned PEM as a more promising candidate for green hydrogen production, but more recent research suggests that it has failed to achieve industrial grade efficiency.

To present a more recent analysis of the research conducted in the field of green hydrogen, the systematic review articles published between the years 2020 and 2024 were read. A bibliometric analysis of the research trends in green hydrogen provides significant insights for the focus points of the research directions globally (Raman et al., 2022). The authors find four major thematic distributions of research on green hydrogen which are: hydrogen storage, hydrogen production, electrolysis and hydrogen economy. The results further highlight that the hydrogen storage materials, regenerative fuel cells, photocatalytic decomposition of water and industrial application of green hydrogen are prominent research areas in which publications are progressing. Nevertheless, the article being a bibliometric analysis does not provide us with any qualitatative insights but helps interested readers understand about the current dominant areas of research in the field of green hydrogen.

A more recent study in the research development of sustainable production pathways for hydrogen reiterates that PEM water electrolysis method currently holds standard as the most promising method of production (Ng et al., 2024). The research article also sheds light on the integration of renewable energy sources (mostly solar-based) to truly achieve a green pathway of hydrogen production. The study identifies key challenges and improvement areas that further align with rest of the studies which are cost reduction and efficiency improvement for the proposed methods. Further the study goes on to mention that collaboration is necessary among different stakeholders in the value chain for the commercialisation and widespread adoption of PEC and PEM membranes.

2.2. Stakeholder Perspectives

In addition to the technological roadblocks, large scale implementation of green hydrogen in hard-to-abate industrial sectors faces socio-environmental and public acceptance risks (Vallejos-Romero et al., 2023). Asymmetry in knowledge gives rise to concerns amongst stakeholders regarding costs, environment impact and efficiency of green hydrogen projects (Vallejos-Romero et al., 2023). Emodi et al., 2021 state that focusing on policy mix for trade regulations and stakeholder preferences can be a contributing factor towards large-scale adoption of green hydrogen and that by understanding the perception of stakeholders geographically can accelerate the policy implementation and increase acceptance and diffusion of green hydrogen technology.

Increasing number of stakeholders endorsing the use of green hydrogen in a wide

range of sectors indicates a level of overconfidence in the potential of green hydrogen for end-to-end energy usage (Odenweller & Ueckerdt, 2025). In contrast, global climate change reports show that the share of hydrogen in the energy sector is 5-15 per cent till the year 2030 ((IEA), 2023; (IRENA), 2023). These contrasts lead to ineffective policy conclusions and exacerbate the uncertainties and risks around green hydrogen technologies, thereby delaying the climate change mitigation (Odenweller & Ueckerdt, 2025). Understanding and carefully assessing the discourse and perception of stakeholders involved in green hydrogen ramp-up is therefore necessary on an urgent basis.

Globally, several studies have focused on understanding the perspectives of stakeholders in the renewable transition. While there are studies undertaken in countries with a strong backing for the implementation of green hydrogen, majority of such studies have been focused on understanding the perception of stakeholders, particularly in the Western European studies (Emodi et al., 2021). Germany leads as the country in which stakeholder perception has been studied in more than two studies. Similar studies have been conducted for the stakeholders in Netherlands, Denmark, Norway, Iceland, and Sweden. Outside the European Union, similar studies have been conducted in Australia, South Korea, Brazil, and Africa.

Emodi et al., 2021 in their systematic literature review, analyse the existing literature that focused on factors influencing social acceptance and perspectives of stakeholders in hydrogen related technologies. The study was not particularly limited to green hydrogen but analysing the factors affecting public acceptance of the entire hydrogen economy. The study finds that over 60 per cent of the studies were conducted in Western Europe and this points to a gap in Asia-specific insights on this topic. The methodological approaches for most studies relied on survey questionnaires, while other studies used interviews as their main source of data. Common themes of key concepts and issues emerged in these studies which stakeholders in different regions of the world were concerned about:

1. **Prior Knowledge:** Stakeholders/General populace being familiar with hydrogen technology directly affects public acceptance.
2. **Cost-Effectiveness:** Concerns about infrastructure costs
3. **Sustainability Conciousness:** The study also found that stakeholders with stronger environmental conservation attitudes are more supportive towards green hydrogen technologies.

The study further goes on to mention that there is a dearth of research aimed towards tracking how perceptions of stakeholders has evolved over time. Another interesting point to add here would be that since 2021, there have been numerous research publications aimed at understanding stakeholder perceptions and these studies would also need to be looked at for a deeper and recent understanding of the research trends in this domain.

In tune with findings from Emodi et al., 2021, the trends in research publications remain somewhat similar. Schlund et al., 2022 identify a broad coalition of 49 stakeholder groups in Germany. Of these 49 groups, electricity utilities, hydrogen technol-

ogy providers and R&D Institutions appear to be most relevant. In addition, gas-grid operators surface as key prospective infrastructure developers. The study employs a multi-method data collection with 78 real-world German hydrogen demonstration projects and primary qualitative data from 36 semi-structured interviews. Schlund et al., 2022 from their research articulate that the supply, demand, and transport infrastructure would need to co-evolve as transitional measures. An inclusion of social network analysis (SNA) reveals the critial information bridges that some of the stakeholders act as, and suggests that these stakeholder groups are conveners for early-stage coalitions. This is in accordance with the fact SNA focuses only on the relationships between the stakeholders and not their individual interests and characteristics (Otte & Rousseau, 2002).

In another similar study, Häßermann et al., 2023 employ a rigorous mixed-method design. The authors conduct semi-structured expert interviews and two participatory workshops. A crucial result of the study is the strong correlation of acceptance with trust in the scientific sector, and a weaker correlation with trust in government, media, and perceptions of distributive justice. Furthermore, qualitative results of the study reiterate the same result with stakeholder dialogue being presented as a cornerstone of social acceptance. Despite the results, the study has some limitations that need to be addressed. The study does not touch upon any interactions between stakeholders and employs the perspectives of stakeholders with a low degree of diversity.

Jesse et al., 2024 follow a case-based approach focused on Germany and the Netherlands, which involves semi-structured expert interviews, thematic anaysis and visual stakeholder mapping, integrating public data and insights from the interviews. The results of the study flag a cautious optimism for green hydrogen where high production costs of green hydrogen electrolyzers and current insufficient demand deters scale-up. Moreover, the dual nature of policymaker as both promoters and deterrent to policy changes is not favourable for other stakeholders in the network and becomes a point of conflict. The study further integrates public data and interview feedback to develop connections for the actors specifically involved in electrolyzer ramp-up which remains as a highly relevant topic for green hydrogen.

Even though the aforementioned studies look at stakeholder perspectives for green hydrogen, there are some methodological limitations that challenge the validity of the study. For a more comprehensive examination of the hydrogen value chain and the analysis of its historical context, we intend to use a methodology that incorporates diverse stakeholder perspectives that span across a defined timeframe that are often overlooked in technical and economic research (Safronova & Barisa, 2023).

Ohlendorf et al., 2023 in their study analyse the public discourse on hydrogen in Germany through a Discourse Network Analysis of 179 newspaper articles, identifying 139 actors and 30 storylines. The study offers a nuanced understanding of the perspectives of a diverse set of actors and how these perceptions shape hydrogen's role in the energy transition, revealing strong support, coalition and conflict points amongst different stakeholders. The combination of qualitative storyline coding and quantitative network visualisation allows mapping the actors that share similar narratives and the conflicts cluster. A key observation in the study was the intensification of discourse

after 2019 following Germany's net zero commitment, marking the effect of policy milestones on stakeholder involvement. In India, tracking the discourse could reveal shifts in discourse alliances as the announcement of the National Green Hydrogen Mission was a significant policy trigger.

Another similar study was conducted by Belova et al., 2023 which focused on discourse network analysis for hydrogen. The study focuses on extracting insights from highly circulated newspapers in Germany and understanding the stances of actors involved in the discussion of the implementation of hydrogen. The study gives similar results specifying that political actors are the dominant voices in the hydrogen discourse. A slight overrepresentation of business actors was also observed. The study further goes on to focus on segmentation of the discourse into phases which allows for understanding the evolution of the discourse through the years included in the scope of the study.

Here we identify a crucial gap in the existing literature. Despite the increasing body of work on stakeholder mapping for green hydrogen, much of this research is geographically confined to Germany and a few European nations (Emodi et al., 2021). However, the assumption that the findings from these studies can be directly applied to developing countries, such as India is problematic. The European context is marked by a focus on large-scale implementation and competition with fossil fuels and this is fundamentally different from developing countries because the inherent difference in where the priorities lie.

First, Europe's hydrogen discourse largely revolves around its role in decarbonization, with a focus on technological innovation and securing energy supplies against fossil fuel dependence (Lagioia et al., 2023). In contrast, India's green hydrogen agenda is primarily driven by the dual imperatives of achieving energy independence and mitigating energy security risks. The discourse in India is not only focused on decarbonization but is also intricately linked to national economic security, addressing concerns about fossil fuel imports, and fostering local industry growth through renewable energy integration (Sontakke & Jaju, 2021). This strategic shift is evident in the Indian government's emphasis on reducing its reliance on energy imports and developing local capacities for green hydrogen production, which is far less pronounced in European discussions (Sambasivam & Sarma, 2024). Consequently, a policy framework based on European insights would miss the critical socio-political and economic underpinnings that shape India's hydrogen ambitions.

Furthermore, the governance structures in Germany and India differ fundamentally in ways that impact the transferability of research findings. Germany's political system, with its centralized decision-making and cohesive governance, stands in stark contrast to India's decentralized democratic model, where regional variation plays a pivotal role in policy implementation (Zakharov, 2022). India's federal structure means that the discourse on green hydrogen is not only shaped by central government policy but is also significantly influenced by state-level actors, each with its own set of priorities, capacities, and challenges (S. D. Sharma, 2002). In contrast, European countries often operate under more unified policy frameworks, where national-level decisions are more swiftly and uniformly enacted.

The societal context in India also poses significant differences in terms of stakeholder engagement. Research on energy transitions in Europe, particularly in countries like Germany, reveals a fairly homogeneous understanding of green hydrogen's role in the energy transition. This understanding is shaped by a largely affluent, environmentally-conscious stakeholder perception, where the primary concern remains climate mitigation and technological feasibility (Belova et al., 2023; Ohlendorf et al., 2023). Stakeholder engagement in India, particularly with regard to green hydrogen, is characterized by a complex interplay of regional interests, developmental needs, and a relatively lower level of public awareness regarding the potential benefits of hydrogen technologies (Sambasivam & Sarma, 2024). This contextual discrepancy renders European findings insufficient for informing India's policy discourse, as the priorities of Indian actors, ranging from government bodies to industry and civil society are driven by different imperatives, including socio-political concerns such as equitable access to energy, industrial competitiveness, and job creation.

2.3. Evolution of the Discourse

While discourse theory and policy studies have extensively examined how actors construct meaning and legitimacy around socio-technical transitions, relatively few works have addressed the temporal dynamics of discourse. It can be said that the studies that have employed the methodology of discourse network analysis place a significant focus on the temporal dynamic of the studying stakeholder perspective by clear definition of the timeframe in which the perspectives are being studied. This oversight is notable, as discourse is inherently a processual phenomenon, often shaped by external events, policy milestones, actor (re)positioning, and shifts in framing over time. Studying discourse from a static point of view often overlooks how narratives converge, fragment, or reconfigure in response to changing political, technological, or geopolitical conditions (Leifeld, 2017).

Particularly in the context of hydrogen transitions, the previously mentioned studies include a temporal element to study the evolutionary element for stakeholder perspectives. Belova et al., 2023 utilises time-sliced Discourse Network Analysis (DNA) methodology devised by Leifeld, 2017 to reveal how the German hydrogen discourse evolved from one marked by consensus among actors to increasing conflict around production methods, import dependencies, and sectoral priorities. These studies demonstrate that transitions are not merely technical or economic shifts, but also discursive negotiations, whose structure and content shift across phases. Ohlendorf et al., 2023 place their focus of study from 2016 to 2020, while Belova et al., 2023 restricts the timeframe from 2018 to 2021.

However, the studies analysed here raise concerns and limitations in two aspects. Ohlendorf et al., 2023 presents discourse in a given timeframe without examining its evolution across multiple phases. Further, Belova et al., 2023 and Ohlendorf et al., 2023, reflect contexts where pluralism and contestation are institutionalized, while for the Indian case, it can be said that it is ambiguous given the large scale of variation between the states and central government (Ratinen & Lund, 2016; Harbers et al., 2019). These aspects make the discourse studies in Western Europe a poor proxy for understanding the Indian case, where policymaking processes and media structures

and distribution differs significantly.

More recently, Arlt et al., 2025 contribute a distinct perspective by analysing hydrogen discourse through a combination of media content analysis and panel survey data from Germany. Covering the period 2021–2025, their findings highlight that hydrogen remained a niche yet stable topic in public discourse, with low media salience despite external shocks such as the Russia-Ukraine War. Crucially, while coverage intensity remained low, the framing of hydrogen shifted from a climate mitigation solution to a geopolitical and energy security asset. The study highlights that framing change, rather than volume, may be a more sensitive indicator of discursive evolution (Arlt et al., 2025). Additionally, Arlt et al., 2025 find that public attitudes toward hydrogen were remarkably stable, shaped more by reinforcement than active change, and tightly linked to media exposure. The study thus goes one step further to incorporate the perspectives of readers as well to provide an understanding of how the attitudes in general public have been shaped due to media. It also illustrates how discourse can evolve through subtle reframing and consolidation, even in the absence of actor turnover or dramatic shifts in attention.

The aforementioned studies also showcase an element of temporal phase division in the discourse. Drawing from Leifeld, 2017, the studies align with the ideas laid down for slicing the timeframe into different phases for better evaluation of the discourse evolution. For eg, in Belova et al., 2023, the researchers divide the timeframe into four distinct phases. The start and the end of each phase is marked by a significant political trigger and it is expected that the discourse shall shift after the political event. While Ohlendorf et al., 2023 does not provide any distinct divisions phase-wise, Belova et al., 2023 identifies two political triggers that are divided into an ”event” phase and a ”consolidation” phase.

Despite these advances and the aforementioned studies, the temporal knowledge remains underdeveloped in green hydrogen and most other technological transitions, particularly in emerging economies. Most discourse studies in India, including those on energy and climate, either examine single time periods or treat actor positions as static. As a result, there is limited understanding of how coalitions form or dissolve over time, or how dominant narratives adapt in response to policy developments, international partnerships, or competing techno-economic visions.

2.4. The Indian Context

India’s interest in green hydrogen has gained significant traction; more so, after the launch of the National Green Hydrogen Mission in January 2023 (Sambasivam & Sarma, 2024). As mentioned previously, the priorities for India shifting towards the use of green hydrogen primarily focus on reasons that differ from the priorities of the European Union nations. The mission states India’s goals of achieving energy independence by year 2047 and net-zero emissions by 2070 (Sambasivam & Sarma, 2024).

Harichandan et al., 2023 in their systematic literature review of green hydrogen economy in India. The study goes through a corpus of 133 research articles whilst gives us a detailed report of the green hydrogen value chain and provides policy recom-

mendations for the same. The study goes to state that research in India primarily include outputs based on electrolysis, biomass gasification and biohydrogen, hydrogen storage and transport and techno-economic assessment of blending hydrogen with natural gas. The paper critically highlights the lack of indigenous manufacturing capacity for electrolysers and fuel cells and India's heavy reliance on foreign technology and international collaborations. A certain lack of research for the field of social science has also been highlighted in the paper. In the paper's concluding argument, the authors highlight the primary obstacles to India's transition to a green hydrogen economy, one of which is policy inadequacy.

Policy initiatives play a crucial role in accelerating the global energy transition from fossil fuels to renewable alternatives. These policies include regulatory mechanisms, financial incentives and technological support (Werner & Lazaro, 2023). By the announcement of the National Green Hydrogen Mission, India has taken a significant policy step to fostering the development of the hydrogen economy (Sambasivam & Sarma, 2024). Sambasivam and Sarma, 2024 in their analysis of India's National Green Hydrogen Mission state that the announcement of the mission was largely significant for development of India as a hydrogen economy and potentially one of the largest leaders in the hydrogen energy ecosystem. More than 88 projects are in various stages of development across the country with different technologies as keystones for the projects. India's immediate priority is to blend green hydrogen with natural gas and utilize it as a cooking fuel and an alternative to CNG and PNG. In addition, the study also states the need for an improvement in the policy mechanisms by providing specific recommendations such as state-specific policy frameworks and improved financial incentives for increased social acceptance(Sambasivam & Sarma, 2024).

There is a significant impact of stakeholder perceptions on policy frameworks. In the domain of energy transition policies. Stakeholders views and practices are central to renewable energy policies, as they significantly impact socio-political acceptance of the involved technologies (Duygan et al., 2022). For instance, Harichandan and Kar, 2023 in their empirical study for technology readiness level for green hydrogen in India find a certain level of discomfort among few sections of the Indian stakeholders to work on green hydrogen-based technologies. Such a perception gives rise to policy recommendations for focusing on developing green hydrogen intensive skills amongst the workforce.

Even though, India has received some attention in policy and energy studies, there is not a detailed methodological approach taken to understand the individual stakeholder perspectives and to understand the interaction of stakeholders, given the nation's ambitious hydrogen targets. For the scale of the renewable energy sector that is developing in India, there is no systematic analysis of how actors frame hydrogen, how they align or disagree and how these dynamics change over time. The identified research critique is particularly important not just from the point of India, but rather represents a large, decentralized democracy with high developmental pressures and a strong connection between the state and industry institutions. Hence, studying India offers insights into how discourse functions in contexts where actor inclusivity and contestation is more constrained and elite narratives tend to dominate policy direction

(Harbers et al., 2019).

2.5. Knowledge Gap

Despite the growing international focus on green hydrogen, the existing academic literature reveals a significant geographical and thematic imbalance. It is found in the earlier sections that majority of the research of understanding stakeholder perspectives remains concentrated in Europe, with Germany as the dominant case study. The conducted studies in this domain explore various methodologies such as stakeholder mapping, policy discourse frameworks or discourse network analysis and these studies provide us with various insights into how different actor groups construct narratives around policies related to hydrogen. Research done by Ohlendorf et al., 2023 explore the conflict points in the hydrogen discourse and employ discourse network analysis on storylines related to three emerging conflicts that need to be addressed for effective policymaking.

India has set the world's most ambitious target of commitment to renewable energy of 450 GW by 2030. For implementation of renewable energy policies in less-institutionalized governments, countries face significant socio-political challenges. In India, these barriers are limited awareness, weak environmental concern and inadequate government policies. In developed countries such as Germany and Sweden, with more mature renewable energy sectors, there is a strong emphasis on socio-political research and need for continuous policy refinement (Brito Cedeno & Wei, 2024). Stakeholder perceptions play a crucial role in policy implementation in different sectors. Ramirez and Belcher, 2019 in their research find that the perceptions of the technology among stakeholders influences how it is valued and positioned in the policy processes. For India, this gap in understanding hydrogen transition becomes a point of interest for conceptualizing such a study that addresses the gap of understanding stakeholder perspectives.

There is a significant absence of work that seeks to map and analyze stakeholder perspectives, for both the Central and State governments in India, public and private industrial players, R&D institutions, think tanks, environmental groups, etc. India is a federal system where considerable state-level policy variation is present (Swenden et al., 2021). Hence understanding the dynamics amidst regional disparities in renewable resources, industrial infrastructure, understanding these dynamics is necessary.

This thesis aims to address this crucial gap by exploring the discursive positions of key Indian stakeholders in the green hydrogen transition. Discourse network analysis is applied to not only uncover what different actors are saying but also how they relate to one another within a broader network of influence, coalition-building and policy shaping.

3

Theoretical Background

From the literature review section we saw the research gap present in existing literature on stakeholder perspectives. This section aims to find a suitable basis and foundation for the conceptualization and the methodology of the study. Understanding the actors in multi-sector transitions, and the methodological approaches employed to understand their stances and what do interaction networks reveal about the discourse around a technological transition, is what we aim to understand in this section.

Geels, 2002 defines technological transitions as ”changes in the functions of society that happen due to the advent of technology”. These technological transitions not only look at changes in elements of technology but also infrastructural changes, standard practices and industrial networks. Analysis of these technological transitions reveal the interactions between actors, institutions and social practices. An analysis of the transition for green hydrogen hence needs a deeper dive into analysing the interlying networks between actors, institutions, and the perceived changes to the status quo.

3.1. Actors in Technology Transitions

There is a broad range of actors who are engaged in socio-technical transitions and which span a certain time-frame. Dominant actors that play a crucial role in such transitions are firms, industry associations, think tanks, NGOs or policymakers have different and conflicting interests and strategies (Farla et al., 2012). All these actors effectively seek to shape policies that influence these transitions by their strategies (Ohlendorf et al., 2023). In the discourse of these transitions we see an emergence of a group of incumbent actors. Traditionally, these are the actors that promote or oppose sustainability transitions and hold the ability to influence transition initiatives (Späth et al., 2016). Transitions usually see a conflict amongst the actors in itself where there is one faction of incumbent actors who fight against the transitions to protect their established businesses, while there is another faction that may support of even drive transitions. More recently, these incumbent actors have begun to support the transitions when the innovation builds on their existing business model (Ohlendorf et al., 2023). Public statements made by actors about innovations or transitions are usually made for pursuing specific interests of the mobilizing policy support and

shifting the discourse in a particular direction (Bakker et al., 2011; Isoaho & Markard, 2020). Hence, in order to understand the discourse for the provided timeframe in the research questions, the method of discourse analysis can be employed which looks at the language, the argument exchange, and the political nature of an issue in the publicly availble actor statements (Hajer & and, 2005).

3.2. Discourse Analysis

In society, language holds the power to create ripples in the status quo and shift power-balances that impact policy making frameworks. Analysing statements made by actors as received is effective so as to create narratives or storylines in the context of the study (Hajer, 2006). Hajer and and, 2005 terms discourse as ”an ensemble of ideas, concepts and categories through which meaning is given to social and physical phenomena, and which is produced and reproduced through an identifiable set of practices”. This definition of discourse leads to the use of another term, discourse coalition which refers to a set of stakeholders in a discourse that share similar storylines about a particular issue (Hajer, 1993; Rosenbloom et al., 2016). Storylines need to be a key element of the analysis of the discourse around a technology, as these statements by the involved actors allow us to understand these complex narratives in which there are multiple actors and narratives that are discussed (Hajer, 1993).

Discourse does not merely reflect reality, it constructs the power struggle where involved actors participate in imposing their meaning of the situation (Hajer & and, 2005). A social framing theory coined by Snow and Benford, 1988 state that actors frame technological innovations in ways that advance their strategic interests. The emphasised concepts in the discourse depends on the position held by the actors towards the innovation that seeks to transition the society. Understanding discourse from the point of view of actors to understand the influence of regulatory outcomes is hence necessary and needs a methodologically sound approach for a scientific basis. A methodological approach to operationalize the discourse for any debate involving multiple actors can be termed as discourse analysis. This is particularly useful for analysing the nascent stages of a technology (Ohlendorf et al., 2023). Belova et al., 2023 in their study with a discourse analysis approach state that in the context of a particular case study, discourse analysis is particularly useful to understand the context of the discourse content in the political, social and economical terms.

A methodological advancement for bridging the gap between the analysis of language and structure is Discourse Network Analysis (DNA) (Leifeld, 2017). This method proposed by Philip Leifeld, who is also responsible for the creation of the Discourse Network Analyser software, allows the researcher to treat the actor statements as not narratives but data points in a network, where actors are linked by the synonymous or opposing positions on specific concepts. Using this methodology and included software, researchers can import textual data, manually code the statements of actors and generate the network map suitable to their research needs (Leifeld, 2013). Having an application for analysing arguments, DNA has been operationalized to analyse arguments around policy, climate transitions, and even genetically modified organisms (Ohlendorf et al., 2023). This approach has hence been proven in explaining policy outcomes by revealing the structure and coherence of the discourse coalitions

(LEIFELD & HAUNSS, 2012).

Relevant to our case study of green hydrogen, different studies have investigated the discussions to explain the discourse. As seen before from the literature review section, the existing research in green hydrogen using the methodology of DNA is restricted to countries in Western Europe, with a few exceptions. By reviewing the mentioned research we aim to extract methodological insights that might help to shape our study in a methodologically sound fashion. On a broad level, the methodology of DNA is based on amalgamating the analysis of content that can be divided into categories and network analysis. The collected data (in the textual form) is annotated using a coding scheme specific to the case study in question. The statements provided by the actors in the discourse are the basic unit of analysis (Leifeld, 2017). Leifeld, 2017 states that each recorded statement consists of mainly four variables: the actor (the person or organisation making the statement), the concept (a shorter presentation of the contents discussed by the actors), the agreement variable (a dichotomous variable that captures the sentiment of the statement), and date stamp (the day on which the statement is made).

Ohlendorf et al., 2023 employs the use of DNA for studying the emergent discussion on hydrogen. The research uses the idea of storylines to guide the study. The storylines refer to summarised statements for the complex narratives subject to discussion. These storylines are then grouped into topics pertaining to deployment of hydrogen and lines of conflict. The six topics include: *role of hydrogen in climate change mitigation, economic considerations, technical aspects, production methods, hydrogen imports*, and the use of hydrogen. In the analysis process the researchers also find it easier to group the actors making the statements for further analysis of the discourse. The actors are grouped into the respective sector of operations, namely: *Policymakers, Transport Sector, Gas and Heat Sector, Industry, Electricity Sector, Research and Think Tanks, NGOs*. An interesting observation for the researchers during the analysis process was the inconsistent number of statements made by the actors. Policymakers were the most vocal in making the statements, followed by industry actors from specific companies.

Another research study done by Belova et al., 2023 uses DNA for analysing the German hydrogen debate. Drawing comparisons to Ohlendorf et al., 2023, the research study gives six variables to each of the statements provided by the actors involved in the green hydrogen discourse instead of four variables. The study also categorizes the actors based on their organizational affiliations and sector of operations, namely: *civil society organizations, research institutions, political actors, economic actors*. A crucial limitation of the study can be highlighted here. Because the study categorises all the economic actors into one group, the study stands to lose out on important insights that could have been gained from the underlying conflicts and coalitions in the networks between the economic actors. The study also categorises the stream of discussion topics resulting in the codes that help to explain the concepts, namely: *Application (areas of hydrogen use), Leadership (achievement of leadership in global hydrogen market), Opportunities (potential benefits from hydrogen development), Organization (concerns about hydrogen economy development), Potential (issues related to hydrogen production), Strategic cooperation (organization of cooperation with*

external players).

Discourse network analysis therefore provides a powerful theoretical basis for understanding the network interplay between different actors having similar or conflicting viewpoints. By exploring the dynamics of changing viewpoints, DNA allows researchers to analyse valuable insights for understanding the shifts in systems that guide and influence policy outcomes.

4

Methodology

4.1. Research Design

The research adopts a qualitative approach embedded with an element of discourse network analysis, which in itself is a combination of qualitative content analysis and social network analysis (Leifeld, 2013). Through systematic extraction and coding of actor statements in major Indian newspapers, the study aims to answer the aforementioned research questions. In this section, we will try to align the research design precisely with the research questions to uncover the key concepts, actor coalitions, and stances have shifted across different temporal phases (Leifeld, 2017).

Discourse network analysis is a detailed framework based method for analysing how stakeholders in the discourse for green hydrogen align, whilst having conflicting or favouring positions on green hydrogen (Leifeld, 2017). We aim to map the relationships according to the actors and their respective positions using the discourse network analyser software and uncover patterns of influence to identify both incumbent and marginalized actors (Leifeld, 2024).

In order to scope the study, we shall define the parameters of the study to ensure a closed, verifiable corpus. The data basis for the research would involve newspaper articles. Newspapers offer distinct methodological advantages for discourse network analysis in comparative policy research. Studies report that their standardized format enables reliable coding procedures and network construction (Blokker et al., 2023). Newspapers preserve historical records, which supports longitudinal mapping of policy debates (Leifeld, 2017), and increasing digital archiving improves data accessibility (Lapesa et al., 2020). Their uniform reporting also permits the development of comparable frameworks and supports both manual and hybrid (manual plus computational) methods across diverse cultural and linguistic contexts (Gruszecka & Pikusa, 2015).

As part of methodology of the thesis, defining the temporal scope of the study is crucial to capture the interaction dynamics and idea development. Choice of the temporal scale for the thesis significantly impacts the analysis results and matching the networks to the inherent timescales is necessary for understanding the underlying interactions (Caceres & Berger-Wolf, 2013). For the study, the temporal scope spans

from January 2020 to April 2025. The year 2020 marks the point at which green hydrogen as a potential alternative fuel, began receiving substantial attention in India's policy landscape, making it a natural starting point for examining the evolution of discourse. The end of the discourse marks the time when the study was in progress and the other end of the temporal boundary captures the ongoing policy discussion and the subsequent budget boost provided that continue to shape the hydrogen discourse in India.

As a part of the research design, we would also need to define and justify the parameters of the study. As we have selected newspapers as the most appropriate data basis for the study, the time criterion would also need to be defined. The time criterion selected for the study ranges from 1 January 2020 to 1 April 2025. Throughout the time criteria, we aim to study how the discourse has evolved around green hydrogen in Indian actors.

In the first stage, the newspaper articles will be coded on a sample of direct quotes from actors featured in Indian mainstream media articles (specifically from The Times of India and The Economic Times). These quotes will be qualitatively coded to identify the actors' stances as optimistic, skeptical, or neutral toward green hydrogen, based on their references to key policy themes. Further, discourse network analysis shall be implemented on the results of the first stage to understand the narrative around the niche but rapidly evolving technology of green hydrogen. This stage allows for a visual, structural and a contextual understanding of the policy discourse.

In order to review the literature research for the mentioned research objective, Google Scholar search engine was used. Google Scholar provided all the scientific research papers needed and mentioned in the Literature Review section. For the collection of the newspaper articles, LexisNexis, an online database for newspaper was used (LexisNexis, 2023). Through this website, the newspapers were filtered and downloaded. The downloaded newspaper were then imported to the 'Discourse Network Analyser', a software created by Philip Leifeld for coding and maintaining databases of the actors, statements and stances of the actors in the discourse (Leifeld, 2024). The software also has the ability to export files from the software for generating the network diagrams. For our analysis, Visone, a software produced from ETH Zurich shall be used for generating the visual representation of the nature of interaction between the actors (Belova et al., 2023).

At the end of this research, it is expected that dominant actors and themes in the hydrogen discourse in India would be successfully identified. The study shall also visualise the discourse coalitions and how the discourse has evolved over time. Furthermore, an assessment can also be conducted from the results of the study, to interpret whether the discourse has become more polarized, more fragmented or more convergent in the years that are to be considered for the study.

4.2. Data Collection

For this research, we will be relying on a single data source which can provide us a multi-faceted approach to the topic. The data source would need to be able to capture opinions of many different actors. Articles from media outlets would be the

best source for such an approach and for this function we will be using Nexis Uni, an online database containing archives of major newspapers and business-related documents.

In the context of India, Times of India and Economic Times, two of the leading newspapers for the business and urban development perspectives (Baas, 2019), consistently reported environmental policy with a dominant business lens (Boora & Karakunnel, 2023). We observe a critical literature gap here, as we do not have any scientific information regarding the readership of the newspapers in question. Nevertheless, the patterns in the conducted research suggest that The Times of India and The Economic Times cover a wide range of stakeholders with a slight tendency to skew towards elite, business, and upper-middle class perspectives (Baas, 2019).

The articles were accessed through an online news database portal, Nexis Uni. The search terms were curated for the required results based on information from the Nexis Uni Search Guide (LexisNexis, 2023). The search term used was ”green hydrogen”. India was selected as a regional criteria to solely focus on the articles that were published in India. The time criteria selected was 1st January 2020 to 1st April 2025. In the sources, 4 sources were selected: The Times of India (TOI), The Economic Times, Times of India (Electronic Edition) and Economic Times (E-Paper Edition). This inclusion ensured capturing all of the articles published under the sources that were available both online and offline. The search resulted in a total of 3114 news articles. These articles were downloaded into the researchers work environment. Thereon, using the coding environment in R, the duplicates and irrelevant articles were removed. The result gave 526 articles with direct actor quotes in each of the news articles. Since we will be also focusing on discourse network analysis, we will be using individual actor claims as the unit of analysis, structured as actor-concept-agreement relationships (Leifeld, 2017). Moreover, the study conducted by Belova et al., 2023 applies discourse network analysis only on actor claims from German newspapers.

The newspapers are retrieved from a online news database, Nexis Uni. The search term used for retrieving news articles is ”green hydrogen”. This search term provides us with all the newspaper articles published around the world related to green hydrogen. In order to scope the news articles for selecting the most relevant articles, the ”Timeline”, ”Region of Publish”, ”News Source” and ”INCLUDE is equal to ’green hydrogen’ was specified in the Nexis Uni database as search criteria. To remove the false positives and irrelevant articles, an approach used by Ohlendorf et al., 2023; only the articles in which ’green hydrogen’ was mentioned at least three times, were selected. Further, there were multiple false positive articles, which showcase the opinion given by the author of the article, and who is not a key stakeholder in the green hydrogen discourse in India.

Further, these newspaper articles were imported into the Discourse Network Analyser software. The software produced and maintained by Philip Leifeld allows for qualitative coding of articles and highlight relevant statements made by actors, assign a stance to those statements, and mention the organizational affiliations of the tagged actors. The software also provides the ability to export network files into network visualisation softwares (Leifeld, 2024). All the included and coded newspapers can be

seen in Appendix E

4.3. Data Analysis

4.3.1. Content Analysis using Manual Coding

To understand the perspectives of key actors involved in the value chain of green hydrogen analysis, contextual analysis is necessary in terms of the underlying complexities and nuances. Xiao et al. describes the process of qualitative coding as a method to derive coded data to derive theory and understand the phenomenon. For our research we will be employing a deductive approach by employing a codebook from 'deductively predefined concepts' generated by Belova et al., 2023; Ohlendorf et al., 2023 The categories then accordingly can be improved inductively as we go through the data. The codebook shall be iteratively improved. (Leifeld, 2013; Belova et al., 2023; Ohlendorf et al., 2023)

Initial familiarization with the discourse was done by going through the dataset of 1240 newspaper articles. Each of these articles were published in the given timeframe of the study and contained the phrase 'green hydrogen' at least once. Here, the articles the researcher to understand the involved actors, their stance on green hydrogen, and the actor-specific concepts that are discussed in the discourse. Initial observation for these articles that most of the articles selected provided no significant contribution to the discourse in terms of statements or stances. Hence selecting the correct articles was done by eliminating the irrelevant articles. This elimination resulted in 316 articles forming the final dataset for the study. These 316 articles contain the phrase 'green hydrogen' at least thrice ensuring a the selection of most relevant articles for our study.

A deductive approach was initially employed to guide the coding process on the statements made by the actors in the newspaper articles. Derived from (Schlund et al., 2022; Belova et al., 2023; Ohlendorf et al., 2023), the codebook provided by the researchers allowed for structuring an initial sample into a framework for coding statements. The deductive codebook was used on an initial sample of articles. Since each year in the given timeframe (2020 - 2025) contained an unequal and an exponentially rising number of articles, a relatively equivalent number of articles were selected through which the codebook was passed.

The deductive codebook used for the research did not incorporate for the varying nature of all the statements made in the selected newspapers. As the coding process went forward, new codes were added for the statements that were not covered by the previous codebook used for coding the articles. To incorporate the new statements, the deductive codebook were added with more codes under the same categories maintained, congruent to the deductive codebook. One slight modification was made in the "Imports" category of codes. In order to incorporate the statements made related to "Exports", the "Imports" code category was transformed into "Imports and Exports". Hence, the inductively modified categories comprised of: "General Statements", "Economic-related Statements", "Climate-change Mitigation Statements", "Import and Export related Statements", "Technical Aspect Statements", "Use Case Statements", and "Production Methods". The iteratively modified codebook was then passed through the newspaper articles to ensure all articles were included in the

coding process with the latest codebook formed. The deductive codebook that formed the basis of the study can be seen in Appendix A, the added codes that were not included in the deductive codebook can be seen in Appendix B, and the final codebook that was used for coding all of the 316 newspaper articles can be viewed in Appendix C.

When analysing each article, the statements made by actors were first identified and broken down into individual statements. Each individual statement represents a single claim or assertion related to the concept being discussed by one specific actor. For instance, if a quote discussed both 'green hydrogen production method' and 'technological challenges,' in one single sentence, the quote would be broken into two individual statements. These two individual statements would then be coded separately and each would be assigned with the name of the actor making the statement, the organizational affiliation of the actor, the concept that the actor talks about, and the stance of the actor on that particular concept. When a statement contained multiple concepts, each concept was treated separately. For example, if a statement discussed both the "economic opportunities" of hydrogen and the "technical aspects", each part of the statement was coded with its respective stance. This means that each individual statement was independently assigned a stance according to the actor's position on that concept.

By conducting the coding procedure, the results comprise of all the statements made by the actors. 46 statements were recorded in the timeframe of the study. These 46 statements were coded 1064 times. Moreover, 149 organizations were identified along with 187 actors making the statements.

4.4. Actor Categorization

Based on existing literature, the actors are categorized into seven categories. By accurately categorizing these actors into these categories, the underlying networks can be better interpreted, thus providing us with a clearer picture of the sectors which are in coalition against the sectors which are in overall conflict. These seven categories are defined as: actors from energy sector, industry, NGOs, research and think tanks, transport sectors and actors known as policymakers, belonging to the governmental institutions. These seven categories are colour coded accordingly to ensure accurate and clearer depiction of network visualisation and to aid the interpretation of these networks.

4.5. Data Interpretation

The analytical phase of this study focused on interpreting coded data generated using Discourse Network Analyzer software. This stage involved going one step ahead of data collection and coding, and employed a combination of network visualisation, network structure analysis and generating some broad-level insights about the coded data. The analysis involved exporting the coded, raw data in CSV format into Microsoft Excel, through which broad-level insights such as frequency of the number of actors, their statement share, the stance count on each statement, etc.

The two-mode networks served as the foundation for interpretation. These networks

link actors to the specific concepts they discussed in the discourse, and were constructed separately for each of the four temporal phases identified in the thesis. This allowed for a comparative analysis of how discourse evolved in response to policy events and institutional developments, such as the launch of the National Hydrogen Mission (NHM) and the National Green Hydrogen Mission (NGHM). In each phase, the two-mode network revealed patterns of actor engagement, thematic dominance, and emerging alignments. For example, actors such as Ministry of New and Renewable Energy or large industrial firms were frequently linked to dominant concepts suggesting their centrality in shaping the discursive frame.

To further explore actor relationships, the study relied on one-mode networks, where actors were connected to each other based on shared agreement with specific concepts. In this configuration, ties between actors were weighted by the number of concepts they both endorsed enabling the identification of dense clusters. The one-mode network provided insight into the internal structure of the discourse, showing which actors were consistently aligned and which remained peripheral. For instance, core clusters often consisted of government ministries and industrial actors, whereas NGOs appeared more fragmented and isolated. In some cases, research institutions or international collaborators acted as bridging nodes, connecting otherwise disparate sections of the network. This structure allowed for a more relational understanding of discursive power and alignment and considering not just simple frequency counts to consider the embeddedness but also influence of actors within the narrative ecosystem. The visualisations talked about here were conducted in Visone.

Together, these interpretive methods, two-mode and one-mode network analysis, combined with insights generated from building an Excel model to provide data -based insights on the coded statements, provided a multi-scalar understanding of India's evolving green hydrogen discourse. The integration of visual, structural, and statistical insights allowed for a comprehensive examination of how actors and ideas interacted over time, and how this interaction shaped the trajectory of a complex and contested policy domain.

5

Results

This section presents the empirical findings of the study. Derived from a systematic analysis of the public discourse on green hydrogen in India, we explore a dataset of actor statements extracted through qualitative coding. The insights gained from the analysis of the dataset would then be arranged and presented to address the sub-research questions and eventually the main research question. The analysis begins by tracing the key policy triggers and announcements to divide the timeline into distinct phases. Through quantitative visualisations, we examine the frequency and distributions of statements over time, across media outlets and by actor type. The section then identifies the key actors involved in shaping the discourse, their organizational affiliations, and the extent of their engagement. Further, it explores the dominant concepts articulated in the discourse and maps how these ideas vary across actor groups and phases. Special attention is paid to actor stances (agreement or disagreement) with specific claims that highlight the patterns of alignment, contention, and strategic positioning. Finally, the results delve into the structure of the discourse network itself, providing insights into actor coalitions, network centrality, and the evolving role of incumbents in framing India's green hydrogen future. Together, these findings provide a comprehensive, data-driven understanding of how the discourse around green hydrogen has developed in the Indian context.

5.1. Newspaper and Media-level insights

This subsection provides a foundational overview of the media landscape that underpins the discourse analysis of green hydrogen in India. Given that mainstream newspapers serve as the primary data source for this study, it is essential to first understand the characteristics of the media coverage itself. This includes the volume of articles published over time, the number of statements made per newspaper, and the number of organizations that actively participated in the discourse around green hydrogen This high-level view offers insights into the agenda-setting role of Indian newspapers and highlights the channels through which the public debate on green hydrogen has been shaped and disseminated.

In totality, 316 newspaper articles were read and coded. In the graphical visualisation

below we show the distribution of the newspaper articles across the publishing houses, namely: The Times of India (TOI) and The Economic Times. For inclusion of the exclusively online available articles, the statements have been categorised into four groups: The Times of India (TOI), The Economic Times, Economic Times (E-Paper Edition), Times of India (Electronic Edition).

The highest article output was observed from The Economic Times with 133 articles published in the timeframe of the study. The Times of India (TOI) was the second highest publishing house with 88 articles to its name, followed by the online versions of the same publishing houses with lesser number of articles published to their name. The number of statements made by actors in the media is hence correspondent to the number of articles published, evident from the visualisation provided in figure 5.1.

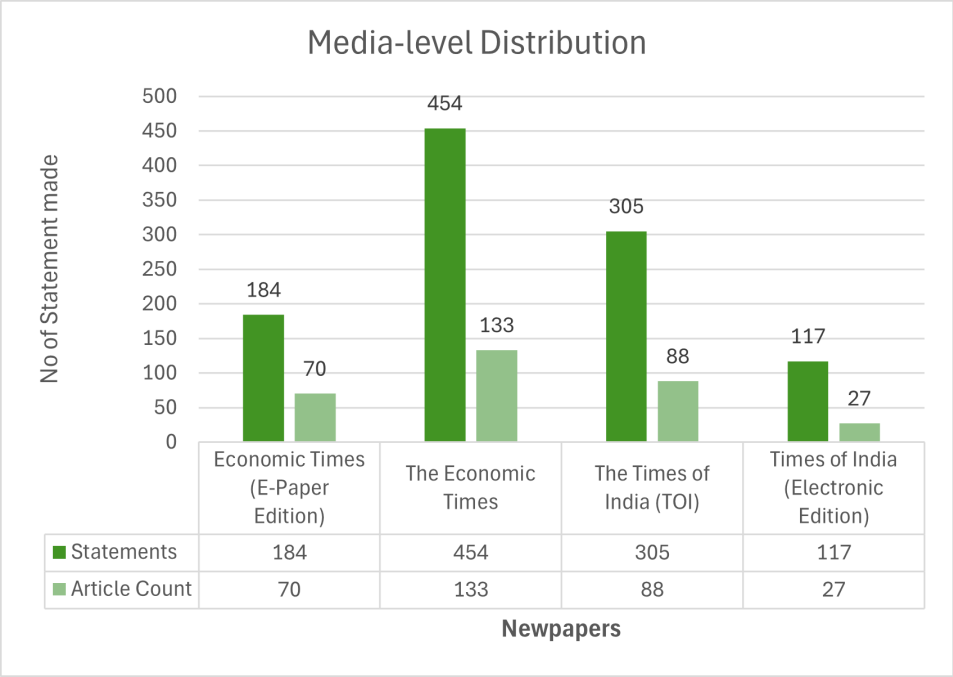

Figure 5.1: Number of Articles and Statements per Newspaper

5.2. Temporal Phase Division

Dividing discourse studies into temporal phases is crucial for understanding the dynamic nature of policy debates and learning processes. By implementing temporal segmentation, researchers can trace the evolution of discourse coalitions, storylines and ideas over the time period of the study (Markard et al., 2021). In a study which analyses statements of actors over time, having a date stamp for each statement aggregates towards an easier segmentation of the underlying statements, hence resulting in coherent network maps (Leifeld, 2017). Hence, by incorporating temporal phases, researchers can better capture the complex, evolving nature of discourse and its influence on policy outcomes and learning processes; rather than analysing the discourse as one static occurrence (Leifeld, 2013).

For discourse network analysis, it is imperative to distinguish the different phases in the policy debates. The first phase can be termed as ”issue emergence”, which is

the period in which the debate starts to take public emergence. The second phase is usually the time period where the policy actors become engaged and get involved. The third phase is the period when formal policy triggers start to get implemented (Penna & Geels, 2012). In the context of the discourse around green hydrogen, Belova et al., 2023 identifies two key political events that act as political trigger for their study. The study is not necessarily divided into distinction points as highlighted by Penna and Geels, 2012, but does certainly divides the study into periods before and after the policy triggers to incorporate information on a more granular level.

Here we try to identify significant policy triggers for slicing the discourse in a way that reveals the underlying shifts in the policy debates happening in India around green hydrogen. The announcement of the National Hydrogen Mission by the Government of India in 2021 was a significant step towards starting the policy debate around hydrogen and its role in achieving the targets laid down by India for achieving energy independence by 2047 and net-zero emissions by 2070 (Ministry of New and Renewable Energy, 2022; Sambasivam & Sarma, 2024). By proposing to launch this mission the Government of India aimed to generate the vision and strategy for manufacturing and applying hydrogen as a fuel in identified segments of use cases (Ministry of New and Renewable Energy, 2022). The second policy trigger was the official formalisation of the National Green Hydrogen Mission in 2023, where the government laid down the mission objectives with clear directives given to the actors involved in the value chain for green hydrogen development. This involved role definition for actors in the public as well as the private sector with directions given to state-level governments as well (Government of India & Energy, 2023). Other than these policy triggers, no significant moments can be identified that have progressed the debate or are genuinely related to the topic of green hydrogen.

Based on the identified key instances, the study divides the timeline into four distinct time-periods, which would hereon be referred to as ”phases”. Each phase is anchored around a significant policy event and loosely follows the approach followed by Penna and Geels, 2012, where the researcher divides the timeline in progressive phases. The study hence allows for an examination of the narrative progress, and how actor participation and alignment patterns shift as the debate around green hydrogen matures.

The first phase is termed as, ”National Hydrogen Mission (NHM) Phase”. This phase captures the period in which green hydrogen began gaining traction as a strategic energy priority in India. This phase includes early signalling by involved actors. Preliminary references given by dispersed actors, speeches made by actors mentioned in the media, were some of the salient features of this phase. The announcement of the National Hydrogen Mission on a public platform by the government on 15th August 2021 acts as the policy trigger. Although the discourse was sparse in this phase, it created room for discussion and laid the groundwork for actor engagement in the debate.

The second phase is termed as, ”National Green Hydrogen Mission (NGHM) Launch”. This phase captures the period of consolidation of the National Hydrogen Mission into a structured Green Hydrogen Policy, which is termed as the ”National Green Hydro-

gen Mission". This period marks the beginning of increased actor participation, particularly from actors within the public domain, industry leaders and actors belonging to the energy sector. The period was marked with actors engaging in vision-setting, outlining opportunities and initial technological know-hows of the process. The official launch of the National Green Hydrogen Mission by the government served as an effective policy trigger for this phase as it marked the discourse between the preliminary announcement of the hydrogen mission and the final launch of the National Green Hydrogen Mission, marked with clear targets for hydrogen production, industry-specific mandates, and institutional responsibilities. A significant shift from abstract planning to setting concrete directives can be observed here and similarly the discourse exhibits greater involvement of state-level governments, private players and international stakeholders, indicating towards an expansion of the policy network.

The third phase is termed as, "Policy Consolidation Phase". Since there are no significant policy trigger post this event, the study aims to understand the discourse post January 2023 till the first quarter of 2024, when the Government of India allocated a percentage of the budget to provide a boost to the NGHM. The phase articulates a clear roadmap to make India a global hub for green hydrogen production, demand-creation and export. The discourse is marked with the opinions of the actors on the targets set by the government and their progress towards the targets. There is an evident increase about the technical feasibility of green hydrogen, with actors providing opinions with more knowledge about the topic. International collaborations start to become prominent, showcasing India's positive position in the global market as an early mover of green hydrogen. The phase is marked with mainstream knowledge diffusion of India's Green Hydrogen Mission and provision of opinions on India's progress on achieving the set targets.

The fourth phase is termed as, "Budget Boost Phase". The continuation of public and private engagement throughout 2024 and into 2025, is segregated as a new phase characterized by further expansion of the discourse and institutionalising green hydrogen in the energy transition narrative of India. The single policy event created by the Government of India when they allocated a percentage of budget for the development of green hydrogen further emboldens India's position as a green hydrogen hub and acts as a new trigger (*Union Budget 2024 and its implications on the green hydrogen sector in India*, 2024). The sustained evolution of the actor engagement, entry of new actors and increase in narrative complexity, and an increase in the number of actor statements suggests the consolidation of green hydrogen as an imperative policy priority.

Based on this idea of temporal phase division, the study maps the defined actor statements into the phases. In the National Hydrogen Mission (NHM) Phase, actor engagement remained limited, with a relatively low number of statements concentrated among central government representatives and select public sector enterprises. This phase accounted for 109 of the total statements, signaling an emergent but still nascent discourse. The National Green Hydrogen Mission (NGHM) Launch Phase saw a marked increase in discursive activity, 257 actor codes emerging during this period. This uptick corresponds with the formalisation of the mission, as actors from government, industry, and think tanks began articulating sectoral visions, investment

plans, and anticipated policy impacts. The Policy Consolidation Phase recorded the second highest concentration of statements, accounting for 314 statements of the overall discourse. This phase captured a broadening of participation, including state governments, private firms, and international stakeholders, who used the media to respond to mission targets and position themselves within the policy framework. In the Budget Boost Phase, although still unfolding, the highest number, 380 actor statements recorded suggest a stabilisation of the discourse, with a more diverse range of voices discussing issues such as market creation, regulation, and infrastructure readiness.

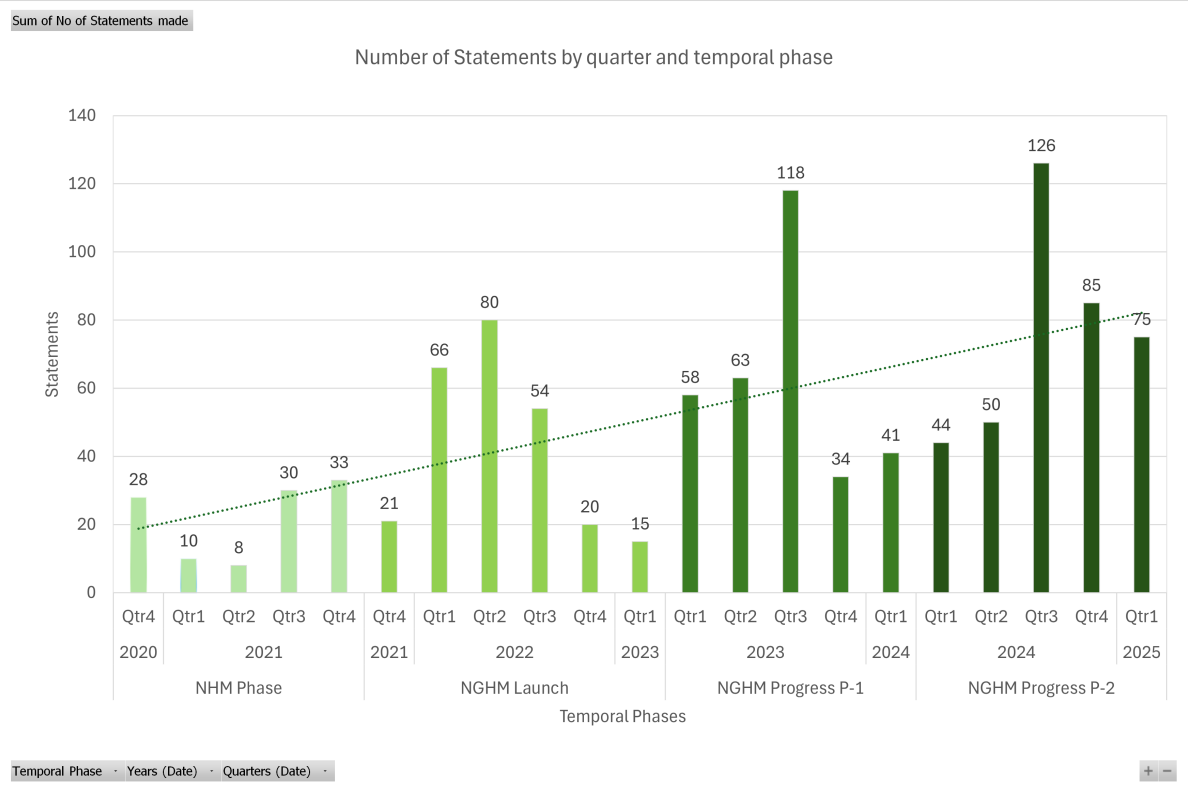

Figure 5.2: Number of Statements per temporal phase

5.3. Key Concepts

This section explores the central concepts that shape the discourse around green hydrogen in India, as articulated by the involved actors in mainstream media. Understanding the key concepts is crucial for unpacking how different stakeholders form opinions about the technological, environmental and economical advantages provided by green hydrogen. The aim here is not only to map the concepts being discussed but also to showcase the strategic interests, expectations, and concerns of the actors involved. By identifying and categorizing these concepts, we can begin to trace the thematic contours of the green hydrogen debate and assess the narrative positions taken by public, private, and international actors across different phases of the policy landscape. This conceptual mapping provides the basis for understanding actors, actor categories, actor alignments, points of contestation, and how policy framing around green hydrogen is being constructed and contested in India.

The discourse reveals a broad spectrum of concepts, which can be grouped into the dominant thematic themes that were initially based on a deductive codebook and then inductively modified as the articles were coded. Based on the coding approach the analysis revealed statements that can be classified into a total of eight categories.

5.3.1. General:- G1-G11

In this category of the recorded statements, the actors make some general statements about green hydrogen. These statements are primarily related to policy, India's green hydrogen mission and India's position as a producer of green hydrogen.

In figure 5.3, the agreement and disagreement count for the general statements made by actors can be seen. In this category, G7: "State-level implementation for GH2" has been coded 55 times, which is the highest occurring statement from G1 to G11. The second-most coded statement was G1: "Policy subsidies/incentives needed". This statement was coded 42 times in the discourse. Both the mentioned statements saw negligible rejection amongst the corpus of actors involved. One of the more contested statements were G2:"India has an effective policy for GH2". This statement saw almost the same number of disagreements as agreements. Another point of contest in the statements was G4:"Hydrogen technology seeing good progress". Some disagreements on this point indicated concerns from certain actors on the overestimation of the potential of green hydrogen.

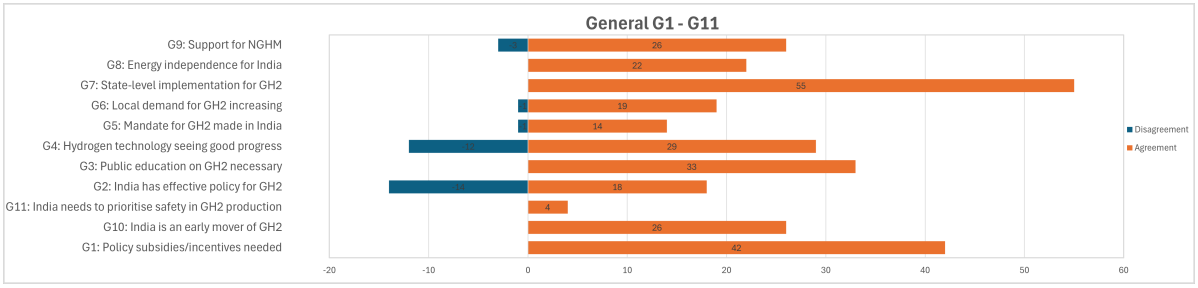

Figure 5.3: General Statements Hydrogen

5.3.2. Economic-related Statements

In this category of the recorded statements, the actors make statements about economical topics. These statements are primarily related to economic opportunities provided by green hydrogen, economic ramp-up options, and economic feasibility of green hydrogen. This category contains 6 statements which have been coded 288 times.

In figure 5.4, the statements do not see much disagreement. Out of the 288 instances that the 6 statements have been coded, E2: "Economic Opportunities" is the most prominent. Almost all the actors making this statement agree that green hydrogen presents a economic opportunity, leading to higher value creation in terms of higher consumption of green hydrogen, employment creation and boost to the nation's economy. There is also a strong concensus among the actors about the cost implications of green hydrogen which is reflected by the statement E1:"Currently Expensive". Most

actors also make the statement that eventually the cost of green hydrogen production will reduce due to advancements in technology and reduction in the sourcing of renewable energy required for the production process of green hydrogen.

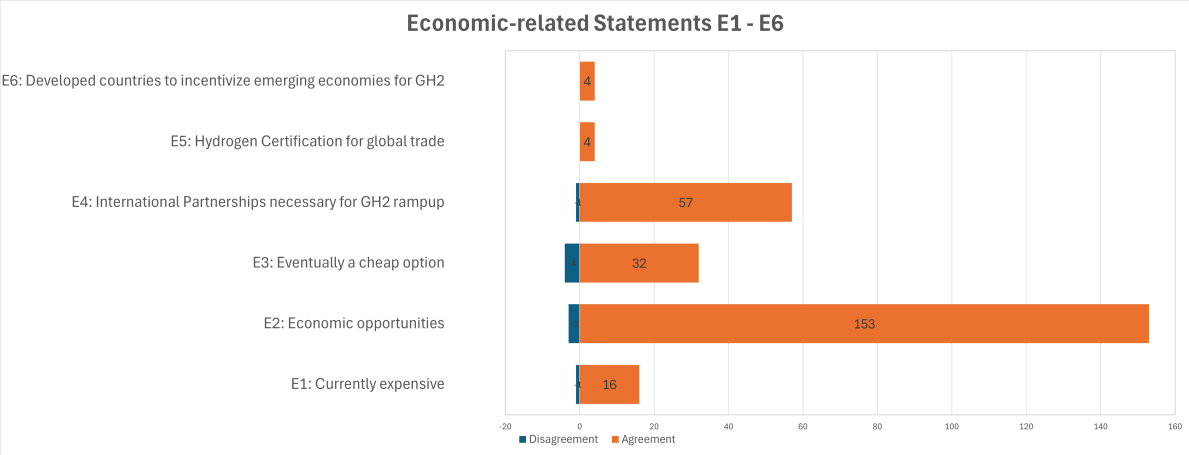

Figure 5.4: Economic-related Statements

5.3.3. Climate mitigation Statements

In this category of the recorded statements, the actors shed light on the functionality of green hydrogen in mitigating the rising concerns of climate change and transition to renewable sources of energy. This category contains 3 statements.

In figure 5.5, the stances for Climate change mitigation statements are listed. Out of the 3 codes, CM1:"Important for energy transition" and CM3:"Required for complete decarbonization" are the ones that were reiterated most by actors. Involved actors definitely recognize the role that hydrogen is going to play in the decarbonization goals and targets posed by India. There are multiple actors which also make the statement of looking at different climate change mitigation options other than green hydrogen. The statements see very less disagreements from the actors and represent a strong coalition on this aspect of the green hydrogen discourse.

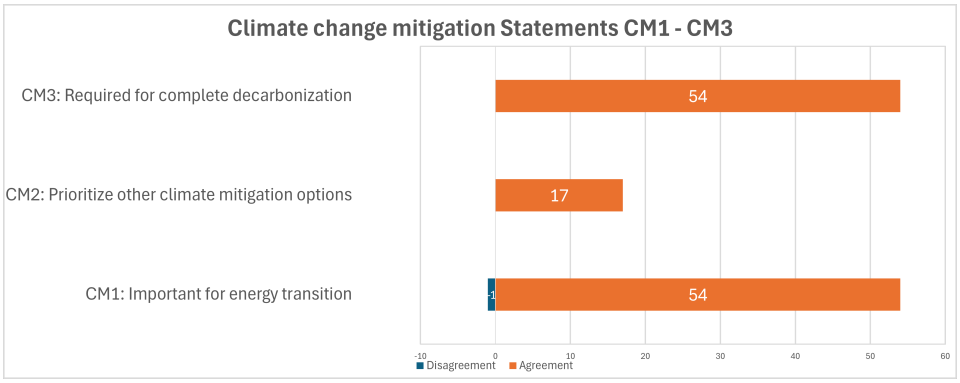

Figure 5.5: Climate Change Mitigation Statements

5.3.4. Import-related Statements

This category comprises of statements related to import of green hydrogen. This category contains two statements which give information about the opinion of actors on imports.

The two statements related to import of green hydrogen reveals two things. Actors in India are not considering imports as an important aspect in the discourse. The low number of agreements for I1:"Imports beneficial" reflect the same. The second statement I2:"Imports concerning". Although this code group sees a lower number of agreement metrics amongst the actor, some of those in the discourse have clearly stated that green hydrogen import should not be promoted within the subcontinent of India. This context can also be imperative to understand for the network and coalition visualisations occuring within these key concepts.

A statement related to the export of green hydrogen was coded 36 times in the discourse. In the discourse, it is clear that actors are prioritizing export of green hydrogen to other nations. The code group X1: India can export GH2 is an indication towards the actors strong position for promoting green hydrogen development and ultimately export it, making India as an economical hub for the same. The high degree of agreement further strengthens the validity of this statement.

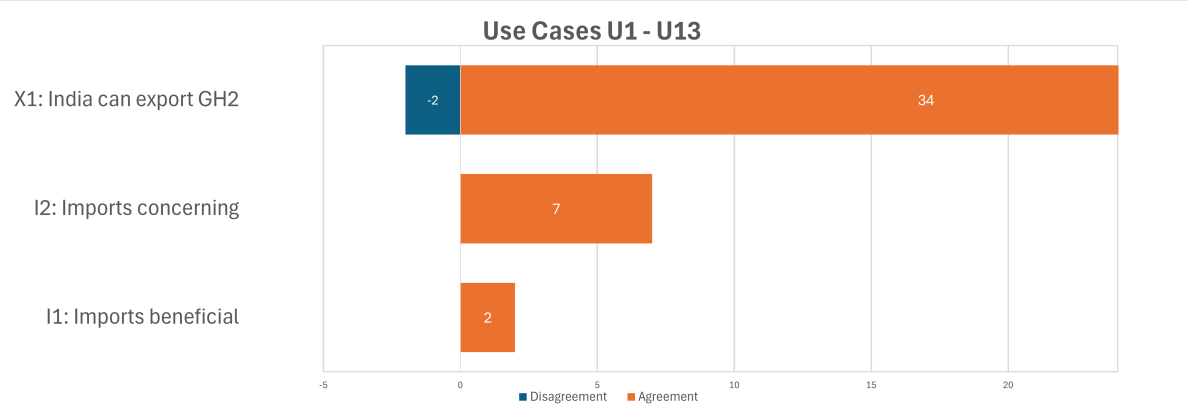

Figure 5.6: Import related Statements

5.3.5. Production-method Statements

In this category, the actors make statements about the production related issues in green hydrogen. Most of the actors involved in the discourse make the statements regarding production targets of the country, and source of the energy used for the production. This category has recorded 6 statements as seen in the figure below.

The statement share of the Production method category can be seen in figure 5.7. The statement that has been coded multiple times was P3:"India has promising production targets". Most of the actors making this statement agreed upon it. In the statements made by actors, the actors primarily talk about the ambitious targets set by the Indian government. This statement sees negligible contest. In the statement list for this category there are 2 conflicting statements: P1:"Exclusively green" and P2:"Non-green necessary". Although these statements are different they are closely related in their

nature of conflict. Almost an equal number of actors make conflicting points here for the production of green hydrogen, either in a complete green (or non-fossil fuel based) method, while others advocate for the usage of fossil-fuel based methods of production initially and gradually transition into the exclusively green method of hydrogen production. Some other statement are related to different aspects brought in for the production of green hydrogen such as, P4:"GH2 production from biomass" and P6:"GH2 production from seawater".

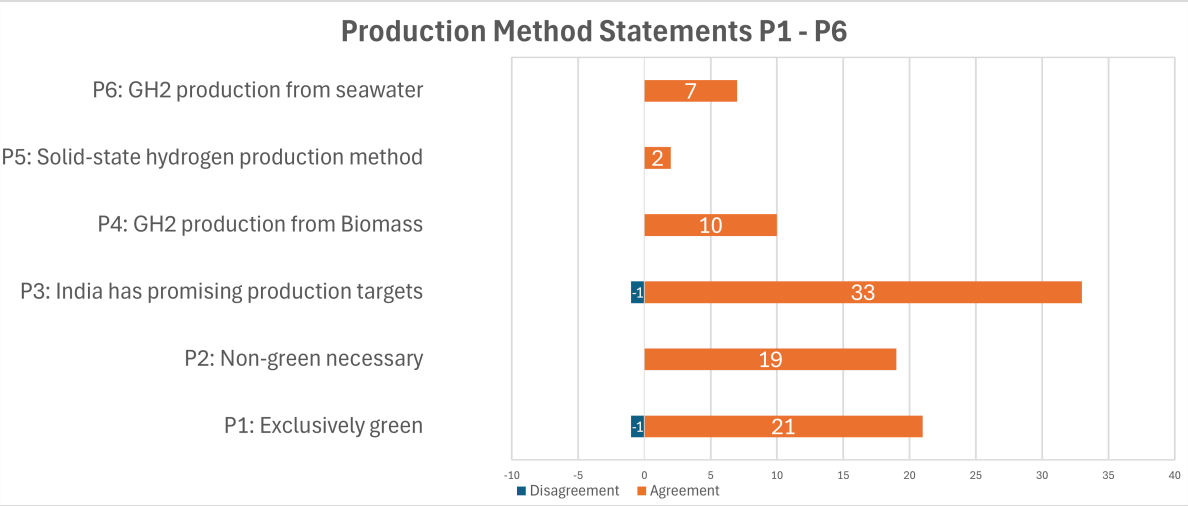

Figure 5.7: Prodution-related Statements

5.3.6. Technical Aspect Statements

In this category, the actors make statements about technical aspects of green hydrogen. The involved actors make statements about the technical feasibility of green hydrogen. This category has 4 statements, which have been coded 27 times in the discourse.

The most prominent statement in this category is T3:"Utilization of existing gas grid". Here, the actors advocate for utilizing the natural gas grid infrastructure. The more contested statements are T2:"Low energy efficiency" and T4:"Hydrogen is easy to transport". Actors are conflicted on hydrogen currently having a low degree of energy efficiency. Actors also show some disagreements on hydrogen being an easy gas for transportation. It can be anticipated that these technical aspects disagreements may have further analysis points with the disagreements in the use cases of green hydrogen.

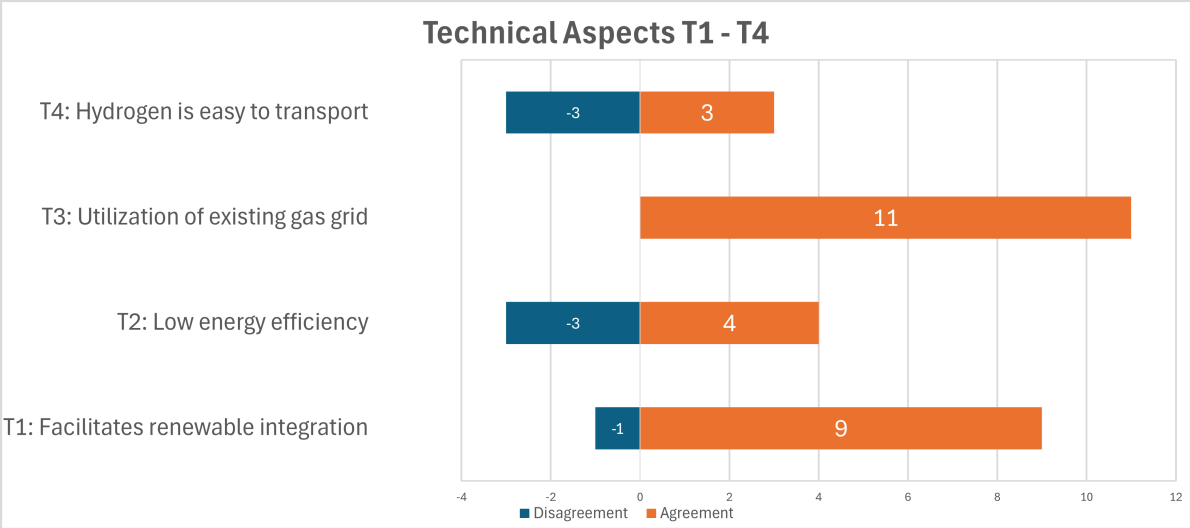

Figure 5.8: Technical Aspects Statements

5.3.7. Use Case Statements

In this category, the actors make statements about the use cases of green hydrogen. The actors speak about a diverse set of industries that can potentially use or are already using green hydrogen. This category has recorded 13 statements from the actors involved.

Figure 5.9 shows the different applications of the green hydrogen gas in the sectors. Use cases such as U4:"Transportation",U9:"Steel industry stand out as the most cited and sees a major agreement stances. India being a historically agrarian economy, there was quite some focus on the use of green hydrogen in chemical industry and particularly for manufacturing fertilizers which is a strong indication of the use of green hydrogen on a grass-root level and this dimension will later be explored in the actor interaction in the discourse networks. The only use case that sees more disagreements in this group is U8:"Passenger Cars", suggesting that the use of green hydrogen in passenger cars is an avenue that is unfavourable to pursue. Some actors also believe in the potential of green hydrogen as an U5:"Energy carrier", indicating strong use case of the gas in the field of energy storage.

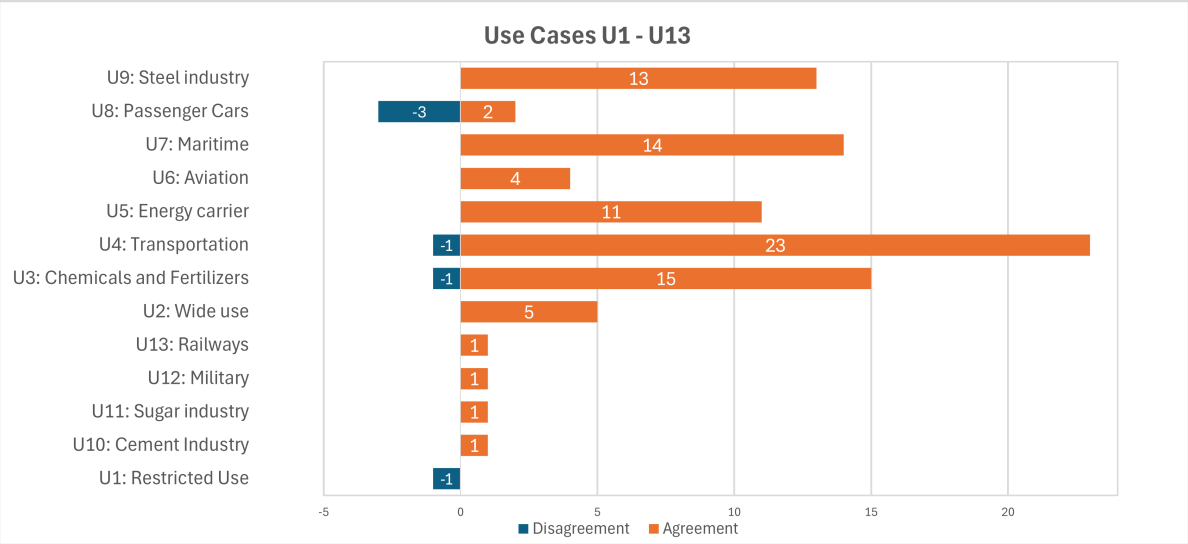

Figure 5.9: Technical Aspects Statements

5.3.8. Phase-wise Statement Distribution

After analysing the conceptual content and actor alignment within each statement group, it is imperative to understand how these key concepts get distributed across the temporal phases of the green hydrogen discourse. By considering the phase-wise distribution of the statement categories, the evolving nature of the priorities in the narratives can be seen. The distribution reflects the changing salience of specific ideas and concepts as the phases evolve over time.

Figure 5.10 shows the share of statements across the phases discussed. The thematic shifts that have occurred in all of the mentioned phases can be viewed here, reflecting the difference in priorities for each phase.

In the National Hydrogen Mission Phase, as seen earlier as well, the share of the statements as compared to the other phases seems relatively low. A salient feature that stands out in this phase however, is that there are a lot more statements that are Economic-related when put in comparison with the rest of the statement categories. Moreover, there were no statements that were Import and Export-related, indicating a negligible priority base for that concept. The initial phase of the discourse shows a lot more interest of the Indian stakeholders in Economic-related activities as compared to the other categories present.

In the National Green Hydrogen Mission Phase, there can be seen a higher number of statements made. This is the phase in which actors start getting involved in the debate and make significant contributions towards making the debate known to a wider set of people. This can be best reflected by the sharp increase in statements seen in the General category. Similar increases can also be seen in different categories such as Economic-related statements, climate mitigation statements, use-case statements, etc. This is in line with the previous findings in this phase, which reflected an increase of actor statements in this phase for the same. Another interesting observation in this phase was the entry of Import and export-related statements. These statement were almost absent in the NHM Phase and the start of the conversation reflects the

discussion being shifted towards imports and exports during this phase. Overall, the growing presence of the Economic-related statements and relatively lesser number of statements clearly reflects the priority of the Indian actors for pioneering the production of green hydrogen.

In the Policy Consolidation Phase, we still see a heavy increase in the General statements, reflecting a strong consideration of green hydrogen in the media discourse and the representation of general issues such as policy, stances of the Indian position on GH2, etc. Similarly the actors maintain the discussion on economic-related topics as well. The discourse surprisingly sees an increase in production related statements reflecting greater interest of the actors in solving the problems and issues related to production and presenting ideas for novel and better ways of producing green hydrogen. A slight decrease in the Use-case related statements can also be seen indicating a shift of the discourse from use cases to different topics.

For the statements in the Budget Boost Phase, the general statements maintain their prominence, congruent to the dominance in the previous phases. Economic-related statements maintain the same prominence as previous phases, indicating the maintained priority of the Indian actors to use green hydrogen for economic benefits. Compared with the previous phases, an increase in Climate-mitigation related statements can also be seen, indicating an increased interest of the actors for using green hydrogen to address the climate change concerns. The increase in the statements related to import and export-related statements, specifically export, can also be seen in this phase, indicating the actors focus on starting the process of exporting green hydrogen gas to different nations.

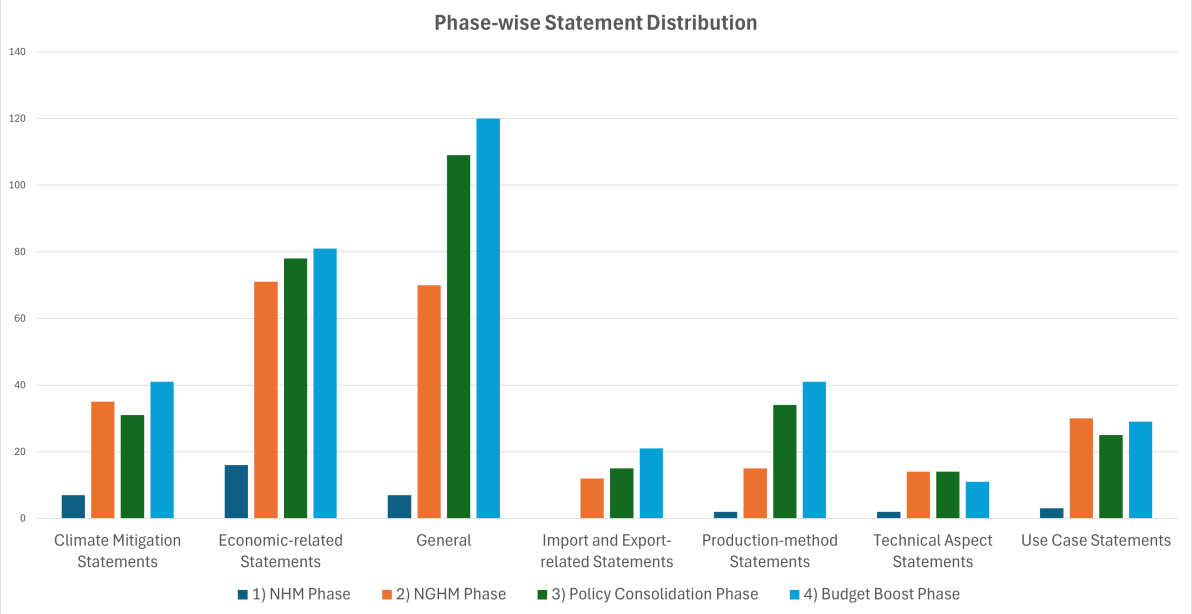

Figure 5.10: Phase-wise Distribution of Key Concepts

Overall, in each phase, the primarily dominant statements remain general and economic-related. General statements comprise 33 per cent of the discourse, followed by economic-

related statements at 26 per cent. Technical-aspect statements form the lowest statement category in the discourse. By unpacking the discursive priorities of each phase, this analysis provides a clearer understanding of how different actor groups adapt their narratives in response to shifting political and institutional contexts.

5.4. Actors in the Discourse

In the given timeframe of the discourse, a total of 149 actors made statements. Based on the organizations affiliations of the actors making the statements, the actors can be grouped in categories accordingly. The actors are categorized in seven categories: Energy sector, Industry, Finance, NGOs, Policymakers, Research and Think Tank, Transport Sector. Across the discourse, the dominant statements were provided by the actors from the energy sector with a count of 41. This count is followed by policymakers with 33 actors making statements during the timeframe of the study. A data point that stands out is the less number of statements from the Transport sector with only 5 actors involved. In addition, there is quite less involvement from the group of NGOs.

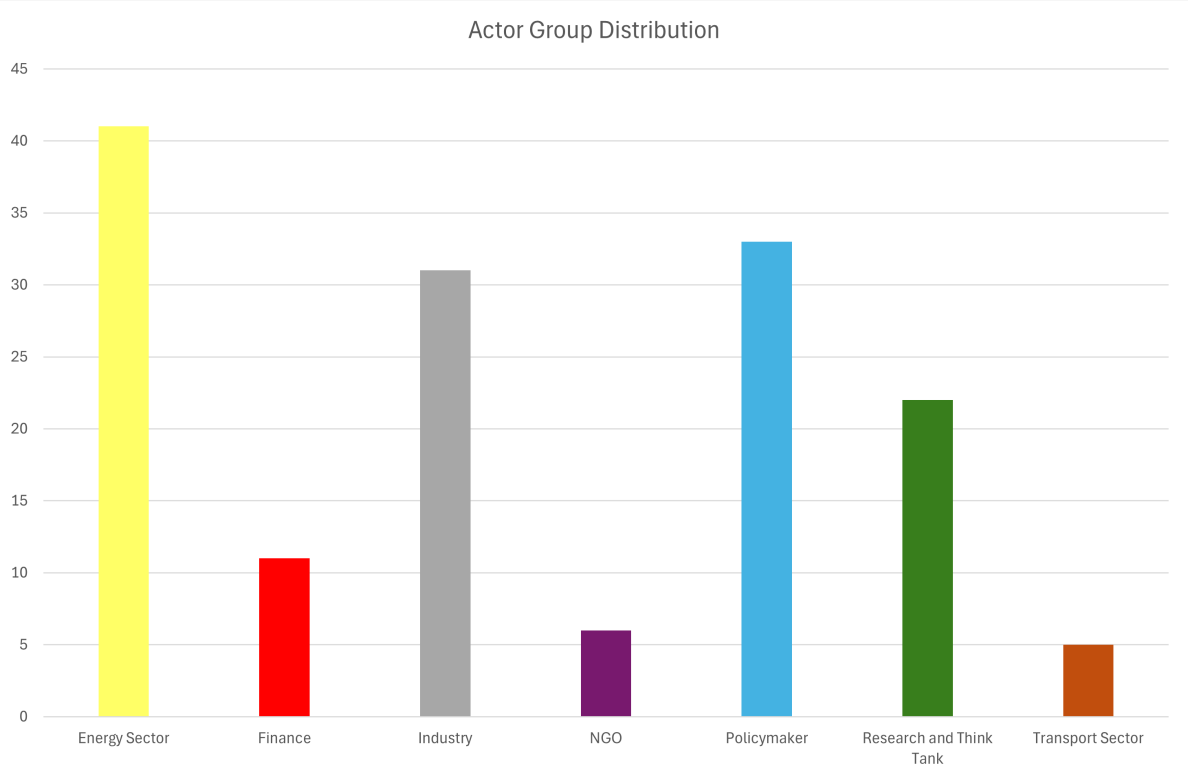

Figure 5.11: Actor Distribution in Discourse

5.4.1. Energy Sector

In the Energy Sector, a diverse range of actors within the industry can be seen.The wide range includes actors who are operating the the energy sector. These organizations are a mix of public companies responsible for energy generation within India. Companies such as Indian Oil Corporation, Bharat Petroleum Corporation Limited , GAIL, Oil India Limited are legacy companies responsible for fossil fuel operations

in India. A majority of the actors in the Energy sector are also organizations in the renewabble energy space. Organizations such as GreenZo Energy, H2E Power, ReNew Power, ACME Group, Avaada Energy are also some examples in this category. Moreover, there are some international actors such as Fortescue Future Industries in this category as well, who represent a vested interest in the Indian Green Hydrogen economy. Lastly there are a few governmental organizations such as Rajasthan Renewable Energy Corporations are also a part of this category.

5.4.2. Finance Sector

In the finance sector, 11 actors contribute to the discourse. Here we see a large proportion of international actors such as Bank of America, World Bank, Morgan Stanley, etc. On the Indian front, banks such as Aavishkar Capital, Guidance Tamil Nadu, State Bank of India, New Development Bank, ICRA, etc.

5.4.3. Industry Sector

The Industry sector makes up for all the organizations operating outside of the energy sector. These actors include industry conglomerates, organizations in the steel industry, maritime sector, sugar industry. The category also contains international stakeholders such as Patton, EY, A.P. Moller, Total Group, Thyssenkrupp, etc. These comprise of the actors who do not have a direct organizational affiliation towards green hydrogen, but have a significant vested interest in the green hydrogen development. There is also a significant interest held by chemical companies such as Linde. In this category, 31 actors are involved and contribute to the discoure by highlighting the statements in the key concepts.

5.4.4. NGOs

In the Indian discourse, there are relatively fewer actors in the discourse. Most of the NGOs such as Asia Society Policy Institute, Confederation of Indian Industry, Global Wind Energy, Independent Green Hydrogen Association advocate for use of green hydrogen for climate mitigation purposes and policy advice for promoting the uptake of green hydrogen within the Indian actors. In the discourse, the NGO category comprises of 6 actors, with actors.

5.4.5. Policymakers

Policymakers play a substantial role in the Indian discourse for green hydrogen. These policymakers are domestic as well as international actors presenting their view on green hydrogen progress across the different phases of the discourse. Domestic actors comprise of ministries in the Central or State Government. A lot of different state governments provide their opinions about the local implementation of green hydrogen and examples of these actors are Tamil Nadu State Government, Himachal Pradesh State Government, Assan State Government, etc. On the International front, the UN Environment Programme, Government of Saudi Arabia, Government of France, Government of Norway, Government of South Korea. We also consider a few outliers who are not directly involved in the implementation of green hydrogen such as Union Ministry of Road and Transport, Ministry of Ports, Shipping and Waterways.

5.4.6. Research and Think Tanks

Throughout the discourse, actors in the research and think tanks contribute significantly providing practical and realistic opinions on the green hydrogen progress. In this category, a plethora of research and educational institutes in the field of science can be seen. These include actors such as Indian Institute of Technology (IIT) Bhilai, IIT Delhi, IIT Indore, Birla Institute of Technology and Science Pilani, Rajiv Gandhi Institute of Petroleum Technology as some of the most prominent ones. In this category, presence of some think tanks, both domestic and international can be seen as well. Council on Energy, Environment and Water, NITI Aayog, Institute of Energy Economics and Financial Analysis are some of the domestic think tanks contributing to the discourse. On the International front, actors such as World Resources Institute, The Energy and Resources Institute and International Symposium on Hydrogen in Matter, provide some significant opinions towards the discourse. Lastly, in this category, some private organizations also add some contribution. Actors such as Agora Research Limited, Nuvama Research and Nomura Research Institute also provide valuable insights for the research.

5.4.7. Transport Sector

The transport sector in the discourse almost negligible contributions with only 5 actors making valuable contributions to the discourse. These actors are Altigreen, Ashok Leyland, Erisha E-Mobility, Hero Group, Zeroavia. These are actors who recognize the potential of green hydrogen in heavy-duty mobility, aviation and some other sectors. In this category, apart from Zeroavia, there are no international actors present.

5.5. Actor interaction in the Discourse network

For understanding the actor interaction in the discourse, there needs to be analysis of the degree centrality and the frequency of the actors in the discourse. By leveraging degree centrality as a core network metric, we identify which actors were most active and influential in each phase, based on their engagement with key concepts and alignment with other actors. By slicing the centrality of actors across the different phases and identifying the most salient actors in the discourse, there shall be an analysis based on the one-node and the two node networks of the discourse.

5.5.1. National Hydrogen Mission Phase

While analysing the actor discourse, there needs to be a consideration of actor centrality to understand how actors position themselves in the process. By understanding the activity levels in National Hydrogen Phase, the actor interaction can be understood.

Figure 5.1 shows the centrality of the most active actors in the National Hydrogen Mission Phase. In this phase, the most salient actor stands out completely, with 'Bank of America', with a centrality of 13.235 per cent. Although being from the finance sector, Bank of America addresses a plethora of the concepts of green hydrogen. An actor with a frequency as same as Bank of America but has a lower degree centrality is Ministry of New and Renewable Energy. This is an indication of Finance actors and

Policymaking actors being aware of the issues around green hydrogen.

Actor	Centrality	Frequency
Bank of America	13.235	10
Ministry of New and Renewable Energy	11.765	10
JSW Group	7.353	5
Reliance Industries Limited	7.353	5
ACME Group	4.412	3
Fortescue Future Industries	2.941	2
Council on Energy, Environment and Water	1.471	1
NTPC	1.471	1

Table 5.1: Actor Centrality in NHM Phase

In table 5.2 the statements and their respective centrality are represented. The statement that can been the most prominent in this phase is E2: Economic opportunities with a centrality of 11.765 per cent. Compared to all other mentioned statements here, this statement stands out as the central concept relevant to most actors due to the high centrality and the number of times actors mention this statement in this phase of the discourse. Another statement that stands out here is CM3: Required for complete decarbonization. The high centrality indicates the actors focus on scaling up green hydrogen to combat the climate change issue and their positive stance on green hydrogen as an answer to decarbonization.

Code	Centrality	Frequency
E2: Economic opportunities	11.765	9
CM3: Required for complete decarbonization	7.353	5
E3: Eventually a cheap option	4.412	3
CM1: Important for energy transition	2.941	2
E1: Currently expensive	2.941	2
E4: International Partnerships necessary for GH2	2.941	2
G1: Policy subsidies/incentives needed	1.471	1
G2: India has effective policy for GH2	1.471	1
G3: Public education on GH2 necessary	1.471	1
G4: Hydrogen technology seeing good progress	1.471	2
G5: Mandate for GH2 made in India	1.471	2

Table 5.2: Code Centrality in NHM Phase

5.5.2. National Green Hydrogen Mission Phase

Table 5.3 sheds light on the ten most central actors in National Green Hydrogen Mission Phase. The most central actor in this phase was H2E Power, with a centrality percentage of 3.670 per cent. Although the actor does not make that many statements

as compared to different actors such as NITI Aayog, H2E Power, being from the Energy sector, addresses the larger number of concepts. For NITI Aayog which makes the most number of statements in this phase, has a fairly low degree of centrality of 2.982 per cent. This indicates NITI Aayog's focus on fewer concepts as compared to the actors who are more central in the discourse. A point to be noted here, is that in the most salient actors in this phase belong to the energy sector, industrial sector, the research and think tanks or the policymaker group. There is no mention of actors from finance, NGOs, or the transport sector.

Actor	Centrality	Frequency
H2E Power	3.670	16
Linde	3.211	14
Ministry of New and Renewable Energy	3.211	17
NITI Aayog	2.982	21
Adani Group	2.064	17
ACME Group	1.835	10
Institute of Energy Economics and Financial Analysis	1.606	7
Nomura Research Institute Consulting	1.606	7
ReNew Power	1.606	7
Reliance Industries Limited	1.606	8
UN Environment Programme	1.606	7
Union Ministry of Road and Transport	1.606	7

Table 5.3: Actor Centrality in NGHM Phase

In table 5.4, the most salient statements are analysed. As compared with the previous phase, once again the most central statement is E2: Economic opportunities with the statement being coded 33 times. This indicates a consistent focus of the Indian actors on economic opportunities related to green hydrogen even across the different phases. With a centrality of 5.963 per cent, E2: Economic opportunities stands out as the most central statement in NGHM phase. Again remaining consistent across the phases, CM1: Important for energy transition, which is a part of the Climate change mitigation statements, is the second most salient statement in this phase. Another interesting observation in this phase is the low centrality of the statement X1: India can export GH2 but a higher frequency than the G7: State-level implementation of GH2, indicating exports being a less central topic than other topics having a lower frequency but a higher centrality.

Code	Centrality	Frequency
E2: Economic opportunities	5.963	33
CM1: Important for energy transition	3.211	16
E3: Eventually a cheap option	2.982	17
E4: International Partnerships necessary for GH2	2.982	18
CM3: Required for complete decarbonization	2.523	14
G1: Policy subsidies/incentives needed	2.523	11
G4: Hydrogen technology seeing good progress	2.294	11
G7: State-level implementation for GH2	1.835	8
X1: India can export GH2	1.835	10
G2: India has effective policy for GH2	1.606	10
G8: Energy independence for India	1.606	9
P2: Non-green necessary	1.606	7

Table 5.4: Code centrality in NGHM Phase

5.5.3. Policy Consolidation Phase

This being the phase that looks at the aftermath progress of the launch of National Green Hydrogen Mission, it can be expected that the concepts discussed in the discourse, will be around E2: Economic opportunities. Nevertheless, a detailed analysis of the involved actor in this phase would warrant some more insights about the actor interaction. The tables below mention the most central actors in the discourse along with the codes that are central to the discussions in this phase.

In table 5.5, an increase in policymakers being more central actors can be seen. In this phase, Ministry of New and Renewable Energy has a centrality of 3.019 with the actor making about 29 statements. From the table, there are seven actors in the top thirteen actors from the Policymakers group. Government of India also remains central to the discourse with a degree centrality of 2.830. The other salient actors in this phase belong to Research and Think Tank group such as NITI Aayog, Indian Institute of Technology Delhi and Institute of Energy Economics and Financial Analysis. All these actors are similarly central to the discourse. A particular actor that stands out is Reliance Industries Limited with a centrality of 1.887.

Actor	Centrality	Frequency
Ministry of New and Renewable Energy	3.019	29
Government of India	2.830	22
Reliance Industries Limited	1.887	11
Ministry of Power	1.698	11
NITI Aayog	1.698	10
Uttar Pradesh State Government	1.698	12
Indian Institute of Technology Delhi	1.509	8
Tamil Nadu State Government	1.509	9
Bharat Petroleum Corporation Limited	1.321	7
Institute of Energy Economics and Financial Analysis	1.321	7
Ministry of Petroleum	1.321	10
Punjab State Government	1.321	10
ACME Group	1.132	7

Table 5.5: Actor Centrality in Policy Consolidation Phase

In table 5.6, congruent to previous tables, E2: Economic opportunities remains the most cited statement. With a centrality of 6.038, the statement remains the most central for the actors in this phase once again. The second-most central statement for this phase is G2: India has effective policy for GH2. This can also be corresponded with the higher presence of policymakers in the phase as seen in table 5.5. Naturally, the policymakers make statements about policy which is reflected in the centrality of G2. Another point to note here, is the lesser number of times Climate change mitigation statements are recorded in this phase. Although the statement having a centrality of 3.019, meaning more actors are talking about the climate change but not that frequently according to the data. A point to note is for E4: International partnerships necessary for GH2, is its lower centrality but higher frequency than the more central statements. Lesser actors talk about the E4 in their discussion, but the number of times that this statement is coded remains higher.

Code	Centrality	Frequency
E2: Economic opportunities	6.038	41
G2: India has effective policy for GH2	3.396	20
G7: State-level implementation for GH2	3.396	20
CM1: Important for energy transition	3.019	17
E4: International Partnerships necessary for GH2	2.830	22
G4: Hydrogen technology seeing good progress	2.830	16
CM3: Required for complete decarbonization	2.075	11
G3: Public education on GH2 necessary	1.887	10
G9: Support for NGHM	1.698	9
X1: India can export GH2	1.698	12
P3: India has promising production targets	1.509	10

Table 5.6: Code Centrality in Policy Consolidation Phase

5.5.4. Budget Boost Phase

Table 5.7 displays the most central actors in phase 4, the Budget Boost Phase. Based on the criteria of the temporal division of Phase 4, where the updated National Budget of India reflected greater value-propositioned focus of the government towards green hydrogen, the most central actors can be viewed from this lens. This phase represents a more diverse set of actors with Policymakers contributing most to this phase, along with energy and finance sector and research and think tanks. This phase also sees two new groups that were never the most central actors in the discourse: NGOs and Transport sector. Confederation of Indian Industry (CII) is the first actor from the NGO group with a centrality of 2.013 and a frequency of 16. Some actors from the finance sector also make it to the list of the most central actors.

Actor	Centrality	Frequency
Government of India	3.020	30
Himachal Pradesh State Government	2.013	16
Ministry of New and Renewable Energy	2.013	16
Confederation of Indian Industry (CII)	1.846	11
AM Green	1.678	13
Avendus Capital	1.510	9
Gujarat Energy Research and Management Institute	1.510	9
International Symposium on Hydrogen in Matter	1.510	9
Ministry of Petroleum	1.510	11
World Bank India	1.510	10
Green Power International	1.342	8
Gujarat State Government	1.342	10
Hero Group	1.342	8

Table 5.7: Actor Centrality in Budget Boost Phase

In table 5.8 once again E2: Economic opportunities remain the most central concept in this phase. Remaining consistent once again across the phases, this is the code that is the most central. As compared to the previous phases such as NHM and NGHM Phase, the second-most central concept in this phase is related to Climate change mitigation statements. Another point to note here, is the the difference in the frequency of the E2 and CM1. Despite the focus of actors on climate change mitigation, the actors focus on economic opportunities remains the primary focus point for most of the actors involved in the discourse, given the high centrality and the high frequency of the coded statements.

Code	Centrality	Frequency
E2: Economic opportunities	5.537	42
CM1: Important for energy transition	2.852	17
CM3: Required for complete decarbonization	2.852	17
P3: India has promising production targets	2.852	21
G7: State-level implementation for GH2	2.517	23
G9: Support for NGHM	2.349	16
X1: India can export GH2	2.349	18
E4: International Partnerships necessary for GH2	2.013	13
G1: Policy subsidies/incentives needed	2.013	13
G10: India is an early mover of GH2	1.846	14
G4: Hydrogen technology seeing good progress	1.846	12
G3: Public education on GH2 necessary	1.678	12

Table 5.8: Code Centrality in Budget Boost Phase

Looking at all the tables mentioning the centrality of the actors and the codes, there can be observed a significant reduction of the centrality percentage in the most central actor in each phase. This is an indication of the discourse getting more complex across the phases and the entry of new actors in the discourse who make the statements. An actor that remains consistent in making statements across all the phases is Ministry of New and Renewable Energy. Although there may be differences in the centrality percentage and the frequency of the statements coded, there is a regular statement provision from this actor on aspects of green hydrogen on a varying level.

All the two-mode networks for all the phases can be seen in Appendix G.

5.6. Actor Interaction and evolution of Hydrogen Discourse in India

To understand the actor interaction in conflicted concepts, one-mode networks need to be used. In the earlier section of key concepts and the associated stances, a general overview is presented on the number of agreements/disagreements seen on a particular concept. A majority of the concepts in the discourse sees an agreement stance overshadowing the disagreement stance in terms of the number of actors talking about the concept. Hence, identification of the contested concepts is necessary. Some of the contested concepts include: P1: Exclusively green, P2: Non-green necessary T4: Hydrogen is easy to transport, T2: Low energy efficiency, U8: Passenger cars, etc. Some more contested concepts exist in the General category, but the large number of actors making these statements does not clearly elucidate the formed coalition groups, leading to exclusion of these concepts. Primary analysis focus is placed more on the concepts that relate to the technical aspect and the use cases of green hydrogen within India.

One of the contested concepts speaks about the technical aspects of green hydrogen, T2: Low energy efficiency. Although mentioned less frequently in the discourse, this

concept sees a fair share of agreement and disagreement alike in different phases. In Phase 1, no actor, other than Bank of America mentions this technical aspect hence the Phase 1 one mode network is excluded here. In Phase 2 however, there can be seen an increase in the interaction of actors regarding this concept. Coalitions can be seen in figure 5.12, where actors such as Ministry of New and Renewable Energy, Linde and Adani Group agree that green hydrogen is a climate change mitigation solution with a low energy efficiency. On the other hand, there are actors such as Thyssenkrupp, Indian Institute of Science and H2E Power which hold the opinion that hydrogen has a high energy efficiency.

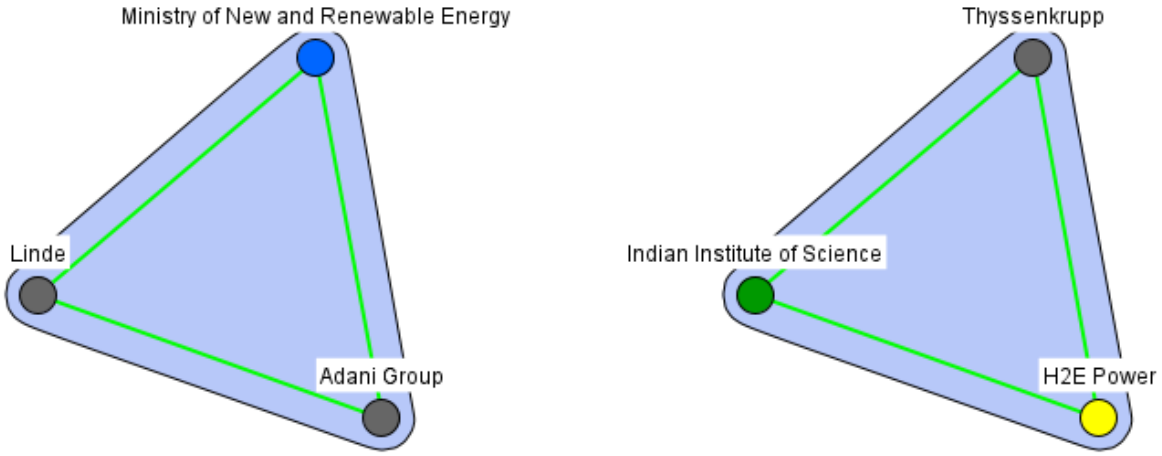

Figure 5.12: One-mode Network of T2: Low energy efficiency - Policy Consolidation Phase

In the Policy Consolidation Phase of the discourse, there are only two actors who present a stance on the energy efficiency of green hydrogen, are Ministry of Power and Avendus Capital. Contrary to the expectations, this phase sees a lesser number of statements made on the energy efficiency aspect of green hydrogen and both of these actors place an agreement stance on green hydrogen having low energy efficiency.

Figure 5.13: One-mode Network of T2: Low energy efficiency - Policy Consolidation Phase

Surprisingly, the Budget Boost Phase does not see any statements for the discussed technical aspect hence no coalitions can be recorded here. An argument for this result is lesser focus of the actors on the technical aspects and more on the economic opportunities presented by green hydrogen.

In the discourse observed, two concepts show up that represent polar opposite perspectives. These are P1: Exclusively green and P2: Non-green necessary. Since

these codes were used in the codebook that has deductively guided this study, the codes did not see much modification. In each phase, if there is a consideration of the coalition groups formed due to the production pathways, it reveals a network structure that can be studied in detail because of the sheer number of actors involved and the statements made by these involved actors. Again, congruent to the analysis of the last statement, this statement shall be analysed phase-wise to understand the evolution of the underlying debate and ultimately understand the evolution of the discourse.

In the National Hydrogen Mission Phase, there is a minimal contribution of the actors on these statements. In this phase, as seen in figure 5.14, there is only the Ministry of New and Renewable Energy and Reliance Industries Limited who shed light on these concepts. Moreover, having differing opinions on the production pathways of hydrogen, there is no form of opinion overlap and hence no coalitions are apparent in this phase.

Figure 5.14: One-mode Network of P1: Exclusively green and P2: Non-green necessary - National Hydrogen Mission Phase

In the National Green Hydrogen Mission Phase, the debates between the production pathways heats up, with the entry of newer actors on the debate of these statements. A variety of interesting coalition group formation can be seen in this phase. As seen in figure 5.15, the larger bubble represents a coalition of the actors that maintain the position that non-green methods of hydrogen production need to be prioritized in the short-term to ensure a smoother transition to green hydrogen. Some outlier actors

can also be seen in this phase such as Department of Science and Technology and JSW Group which maintain the opposite viewpoint of using green hydrogen directly. Nevertheless, although maintaining positions, opposing the populous actors, these two actors see so interaction in this phase.

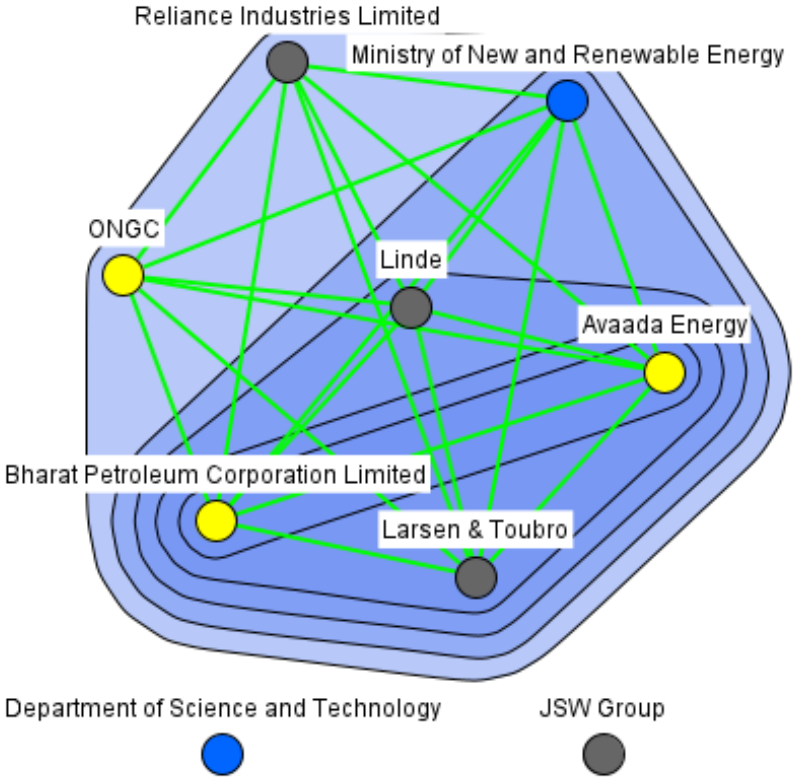

Figure 5.15: One-mode Network of P1: Exclusively green and P2: Non-green necessary - National Green Hydrogen Mission Phase

In the Policy Consolidation Phase, a sharp increase can be seen in the number of actors that support the production pathway of exclusively green. It is observed in this phase, that there is more or less an equal number of actors advocating for both the production pathways. An interesting insight that is presented here is that most of the actors that present optimism of going exclusively green in hydrogen production are from the policymaker group. The other coalition group presents the opinion of moving ahead with the production pathway of non-green methods for hydrogen. This coalition group consists of actors from research and think tanks, industry, and energy sector. Hence the network shows heavy interaction between these actors in the form of the debate and shows the nature of coalition groups for this phase.

It can be seen that in this phase the discourse network exhibits a shift toward greater modularity, with more distinct sub-clusters becoming visible compared to earlier phases. These clusters tend to form around shared priorities based on the statements they make related to the production route, yet they remain connected through bridging actors, particularly government ministries and major industrial firms. The structure no longer appears as a single tightly packed core but as a set of denser pockets of

agreement that are still integrated into the broader network. This emerging modularity indicates a maturing discourse in which specialised discussions develop without fragmenting the overall cohesion.

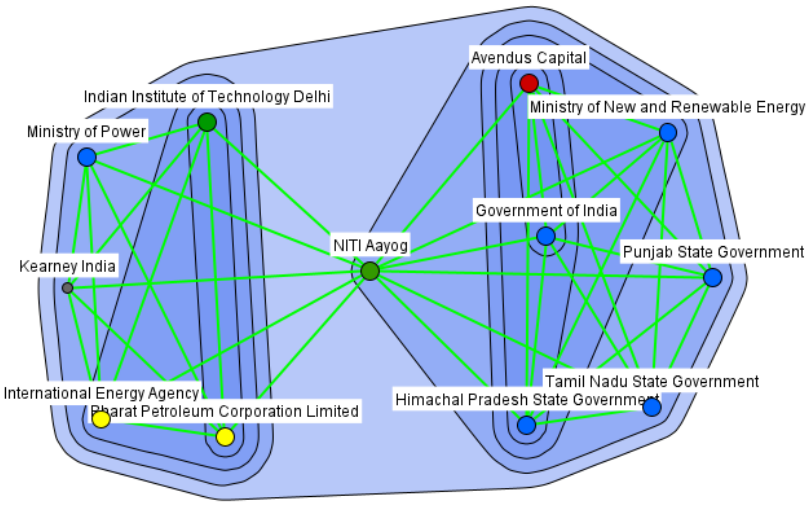

Figure 5.16: One-mode Network of P1: Exclusively green and P2: Non-green necessary - Policy Consolidation Phase

In the Budget Boost Phase, the coalition advocating for an exclusively green production pathway takes clear precedence within the discourse. The network shows this coalition as not only the most prominent in terms of actor count but also as structurally diverse, incorporating participants from multiple and divergent actor categories, including government agencies, private industry, research institutions, and environmental organisations. This breadth of participation indicates that support for exclusively green methods is not confined to a single sector but has become a cross-cutting position that resonates across different stakeholder groups. The prominence of this coalition demonstrates its ability to shape the agenda, as its members consistently frame green hydrogen as the only legitimate production pathway aligned with India's long-term energy transition goals.

At the same time, opposition to this stance remains minimal, with only three actors advocating for non-green methods as a more viable short-term approach. This imbalance in representation suggests that the discourse on production pathways has moved beyond an open contest of ideas and is now increasingly dominated by one prevailing narrative. The evolution of this narrative across the earlier phases where production methods were discussed more ambiguously illustrates how certain concepts can gain traction, consolidate actor support, and ultimately shift the terms of the debate. In this way, the Budget Boost Phase highlights both the growing influence of the exclusively green position and its role in actively shaping the direction of India's hydrogen discourse.

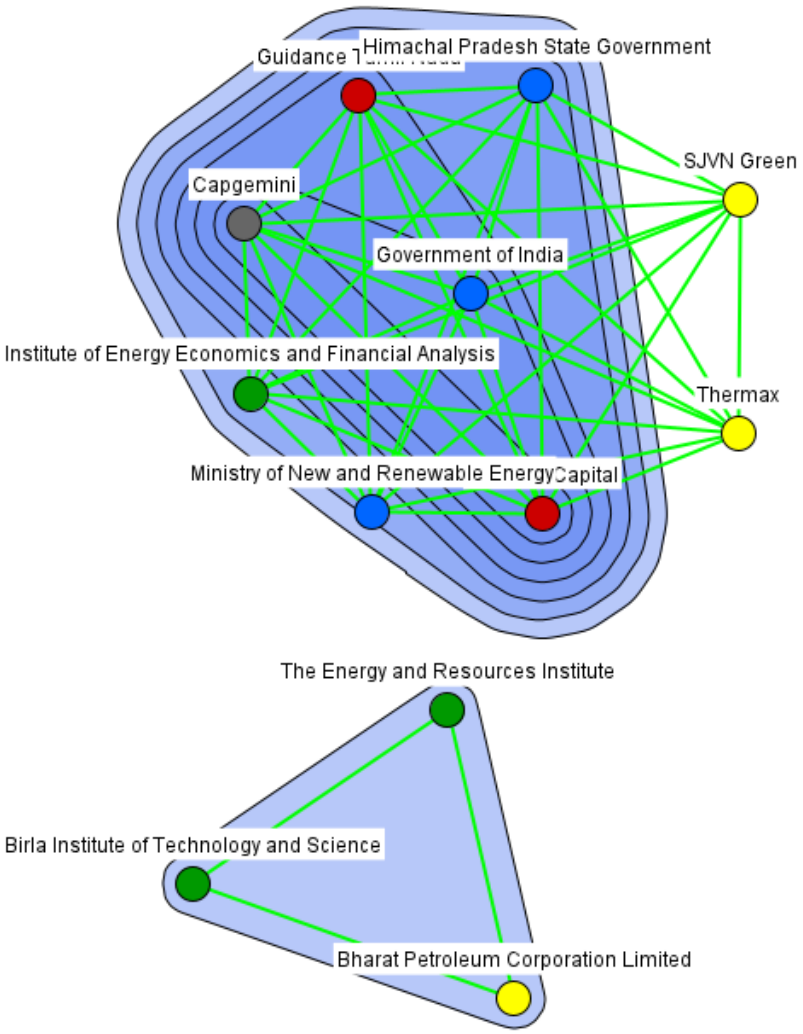

Figure 5.17: One-mode Network of P1: Exclusively green and P2: Non-green necessary - Budget Boost Phase

Another majorly contested concepts is G2: India has an effective policy for GH2. This concept shows up multiple times in the discourse and sees quite disagreement in the different phases of the discourse. Here, the one-mode diagrams for this concept to understand the contestation between the stakeholders in detail.

In Phase 1, the one-mode network for the statement G2: “India has effective policy for GH2” collapses to a single, isolated node, which is the stakeholder Bank of America, without linking it to any other actor. Figure 5.18 represents this. Analytically, this implies near-zero density and no coalition structure around the policy-effectiveness storyline. In keeping with an issue-emergence phase, the claim appears expectations-led and weakly anchored in concrete instruments, reflecting both low coordination and low contestation among Indian actors. The absence of shared ties renders the narrative fragile in this phase, susceptible to rapid reframing once national policy specifics and sectoral interests are more grounded in their approach.

Figure 5.18: One-mode Network of G2: India has an effective policy for GH2 - National Hydrogen Phase

In National Green Hydrogen Mission Launch Phase, the one-mode network for G2: "India has effective policy for GH2" can be seen compact, multi-actor interaction. Central government nodes (Government of India, MNRE) sit in the inner points of network centrality alongside large renewables firms (ReNew Power, ACME Group), with NITI Aayog positioned as a visible broker stitching together government, industry, and sub-national and research based actors (Rajasthan Renewable Energy Corporation Ltd., World Resources Institute). The dense mix of agreement and disagreement shows that while a pro-policy coalition has formed around the central government and major firms, critical disagreements come from the or conditional links from research and think tank actors and some state-level actors. The nested coalitions therefore indicate a pronounced core–periphery: a tightly connected inner cluster, which comprise of the policymakers and the actors from energy sector and the industry, radiating outward to actors whose support is present but less embedded.

The configuration that is seen in this phase aligns with the move from vision to architecture of the national strategy. The formalization of NGHM triffers strategic alignment by actors from the energy sector seeking first-mover advantages for market development. Research and Think Tank actors play a more cautious role to coordinate the interests of both agreement and disagreement stances. The actors holding disagreement stances are accountability-oriented organizations which are concerned more about the technical and political feasibility. These disagreements surface when there are implementation frictions and the standard choices of whose benefit does the policy favour.

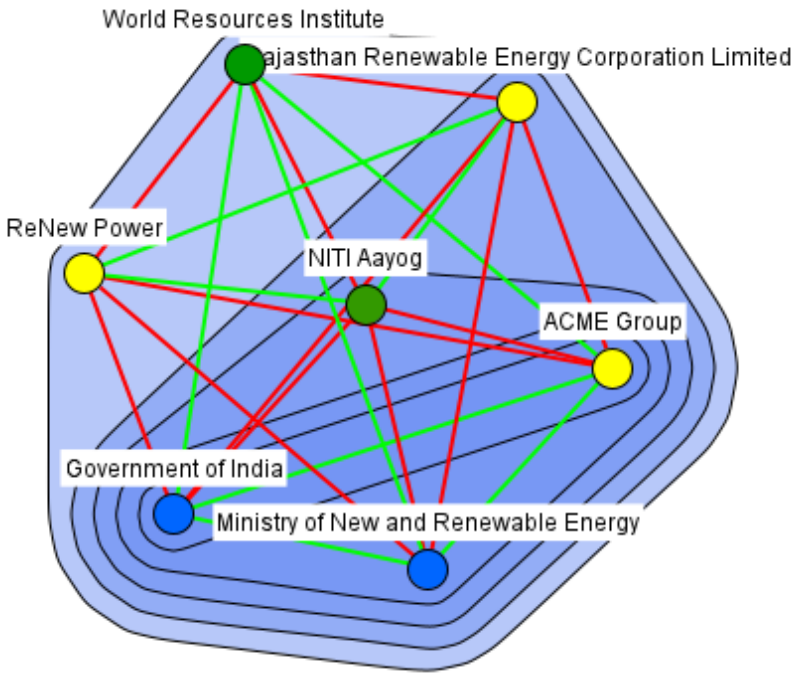

Figure 5.19: One-mode Network of G2: India has an effective policy for GH2 - National Green Hydrogen Mission Phase

The Policy Consolidation Phase, much congruent to its name, represents a dense and complex interaction where central ministries (MNRE, Ministry of Power), multiple state governments (Punjab, Goa, Uttar Pradesh), large industrial and energy sector firms (Reliance, ReNew, Essar, Linde, Thyssenkrupp), consultancies (KPMG, Kearney), and research and thinkthink tanks (GWEC, IEEFA) sit inside the tight inner coalition bonds of the discourse. The web of agreement signals that “policy effectiveness” has become a baseline claim across government, industry, and advisory actors; at the same time, multiple red ties cut across the core, indicating active contestation rather than polarization at the periphery. Central ministries knit together state nodes and firms; large corporates bridge across technology/finance subclusters; global bodies and consultants connect international and domestic narratives.

This pattern represents a deeply complex and diverse narrative due to movement from architecture to execution detailing. As mission architecture is solidified and state-level programs are drafted, a wider set of actors gained concrete stakes, drawing states into the core and pulling in strategy/finance intermediaries (consultancies, global councils) who amplify pro-policy frames to mobilize capital and partnerships. Simultaneously, actors from research and think tanks (e.g., IEEFA) provide insights on evaluation of costs, efficiency, certifications and land–water constraints, producing visible disagreements exactly where implementation choices decide the winners of the narrative setting. Convergence can be seen because policy now enables investable action, while disagreements intensify because distributional and standard-setting decisions are key factors that decide the future of green hydrogen development in India.

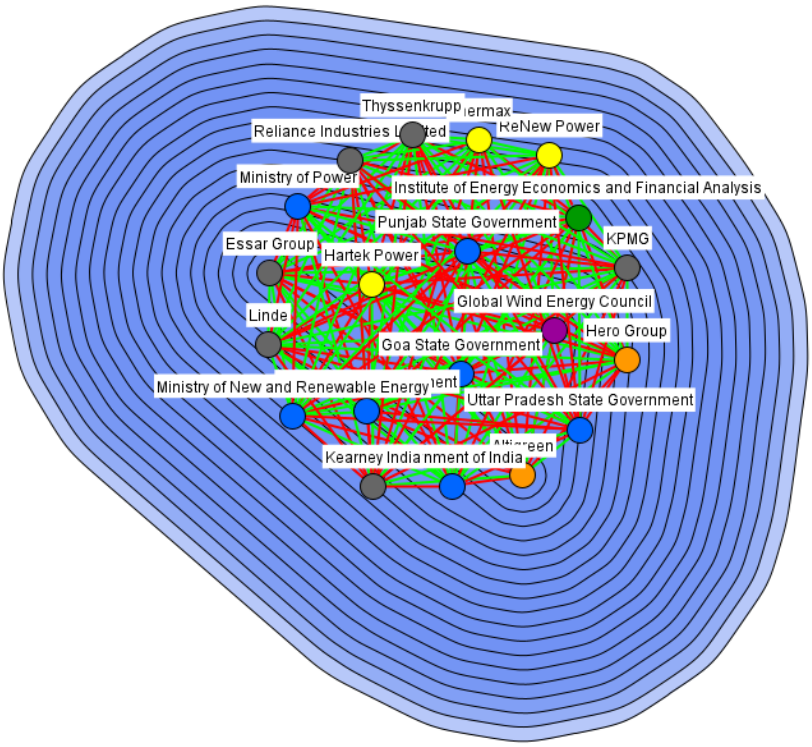

Figure 5.20: One-mode Network of G2: India has an effective policy for GH2 - Policy Consolidation Phase

In the Budget Boost Phase, the discourse compresses into a small, tight core dominated by central government (Government of India, Ministry of Petroleum), an civil society actor(CII), a global finance institution (World Bank India), a watchdog/analytics actor (IEEFA), one state government (West Bengal), and a transaction advisor/-consultancy (KPMG) that sits as the broker. The network is dense inside the nucleus with both agreements and disagreements running, which is evidence of a consolidated coalition that has internalized contention rather than pushing it to the periphery. The nested hulls are tight and few, underscoring a centralized, technocratic debate with minimal periphery participation.

The less complex nature of the network interaction reflects issue maturation and venue shift. Once “policy effectiveness” becomes a settled baseline, most actors stop signaling on G2 and pivot to sector-specific debates (rampup, standards, certification, tariffs), so fewer unique actors agree or disagree to this particular statement in the media. At the same time, implementation moves into closed, technocratic arenas such as finance, compliance, and bilateral state–firm interactions where apex intermediaries (CII), transaction advisors (KPMG), central ministries, and MDBs (World Bank) speak for many, compressing representation in the public discourse. The result is a high-density but low-engaged network: perceived as concentrated, elite participation around G2 while broader actors engage in other concepts in the discourse.

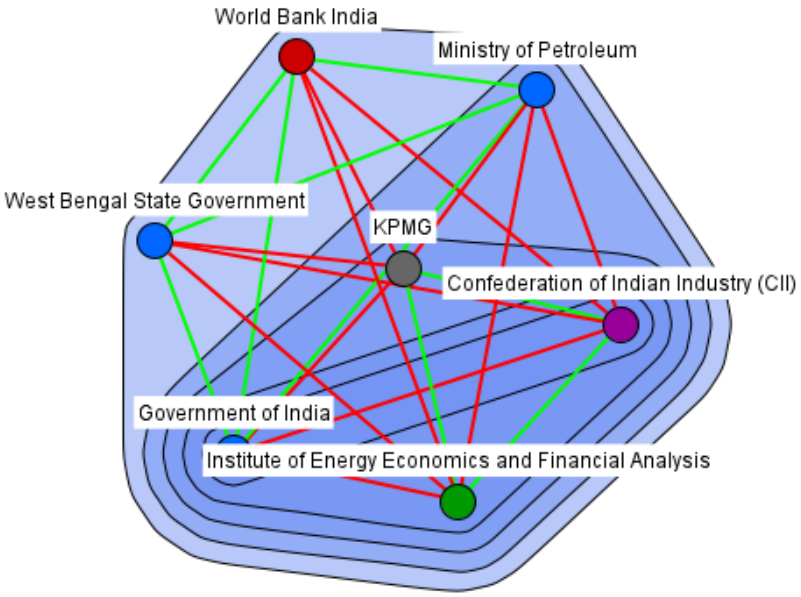

Figure 5.21: One-mode Network of G2: India has an effective policy for GH2 - Budget Boost Phase

6

Discussion

On a broad level, based on the results of this study, it can be seen that the Indian stakeholders present in the study, with a majority consensus, support the idea of the adoption of green hydrogen. Based on the results that have been generated, this section would try to interpret and provide a comparison with the existing literature. Further, the section also tries to condense the results for answering our sub-research questions and eventually our main research questions. Lastly, the section will also highlight some methodological and theoretical limitations of the study along with some focus placed on future research considerations.

The empirical results of this thesis reveal a rapidly expanding and diversifying discourse around green hydrogen in India, marked by growing participation of actors and inclusion of concepts that make the discourse more complex with the passing of each phase. From a methodological standpoint, the findings validate the utility of Discourse Network Analysis (DNA) as a lens to capture the evolution of multi-actor, multi-sector narratives during an emergent technological transition.

A salient feature of the discourse is the high level of optimism shared across actor categories regarding the role of green hydrogen in India's energy transition. This optimism is particularly visible in statements regarding economic opportunities, green hydrogen's potential in climate change mitigation, and India's potential to become a global leader in green hydrogen production. A fairly low degree of divergence can be seen for most categories with the exception of select few For instance, while policymakers and the actors from industry and the energy sector commonly endorse hydrogen's economic potential, they vary in their views on technical aspects of green hydrogen and use cases such as passenger cars. Although these statements are fairly less in number, there is a conflict unraveled in assessing whether green hydrogen has a low or a high energy efficiency.

The stakeholder landscape is dominated by actors from the energy sector, the industry and the government. These groups were not only the most vocal but also the most influential in shaping the discourse. Conversely, environmental NGOs and organizations in the transport and the finance sector remained relatively marginal. Their limited presence raises concerns about the representativeness of the discourse and the po-

tential sidelining of critical voices that could challenge techno-optimistic assumptions. The underrepresentation of actors outside elite political and business networks also reflects the data source's skewed orientation, as both The Times of India and The Economic Times cater predominantly to urban, business-oriented readerships.

Furthermore, despite the growing number of actor statements over the defined temporal phases, there is limited evidence of strong polarization in the discourse. Rather than distinct adversarial camps, the network displays a lot more convergence of actors on concepts. This suggests that the Indian green hydrogen discourse, at this stage, is still in a formative and coalition-building phase, where actors are aligning on broad goals while delaying contestation on specifics such as funding priorities, use case restrictions, or environmental safeguards.

A trend seen across the data in this study are the increasing number of statements made on simply broader level goals and the absence of information on strategic plans or roadmaps on achieving the targets set. Nevertheless, the opposing statements such as production methods (eg, Exclusively green or Non-green necessary) reflect strategic ambiguity in the selected timeframe. Due to the currently developing nature of the discourse, the strategic ambiguity can also be expected to reduce in the future. In the given time frame, actors might be deferring conflict by avoiding specific commitments in a landscape still marked by uncertainty. This pattern aligns with findings from early-phase technology discourses, where actors emphasize flexibility and vision over detailed implementation concerns (Schlund et al., 2022)

Overall, the findings indicate that India's green hydrogen discourse is characterized by high actor diversity, across the sectors, broad rhetorical alignment, and a latent structure of underlying conflict particularly around the legitimacy of different production methods, use cases and technical aspects of the evolving green hydrogen technology in the emerging hydrogen value chains. India's green hydrogen discourse is ambitious by design and strategically convergent in practice. The convergence looks less like spontaneous harmony and more like state–market alignment around investment mobilization and export signaling. That alignment is productive for early momentum, but it also hides unresolved design questions (what counts as "green," who gets scarce molecules first, who bears coordination risk). Unless those choices are surfaced and contested on evidence, today's consensus becomes tomorrow's bottleneck

6.1. Comparisons with existing literature

In this section, a comparison is to be drawn between the different studies in this domain. This offers valuable insights into how socio-political and sectoral contexts shape discourse structures. While the present complex, multi-actor discourse is marked by high levels of optimism about hydrogen's role in the energy transition in different countries where green hydrogen is studied, the configuration, intensity, and focus of stakeholder engagement differ substantially across studies.

As mentioned in the sections focusing on literature, there is a significant portion of the literature restricted to analysis of Western European countries such as Germany and the Netherlands. Findings from Ohlendorf et al., 2023 and Belova et al., 2023, reveal a similarly high level of narrative support for hydrogen across political and economic

actors in Germany. However, in contrast to the Indian discourse, German discourse demonstrates clearer articulation of conflict lines around three main issues such as production methods, imports and sectoral use. This is visibly absent in the Indian discourse due to high levels of agreement on most of the concepts discussed. These divisions are well-documented through Discourse Network Analysis in the German context, where actors explicitly frame their positions in relation to others, leading to discernible discursive clusters. India's discourse, by comparison, remains less confrontational. While differences in opinion exist, especially around production concepts (Exclusively green vs. Non-green necessary) and technical aspects, they are seldom framed in direct opposition. This may reflect a more cautious, coalition-building phase of policy emergence in India, where actors have an interest in presenting a unified front to attract investment and secure policy alignment.

One notable difference is the institutional role of the state. Research conducted by Jesse et al., 2024 studies the perspectives of the stakeholders involved in the hydrogen scale-up in Germany. The study provides a perception that the policymakers in Germany receive a fair amount of criticism, noting ambivalence in how policymakers act as both enablers and bottlenecks to the development of the green hydrogen economy. A key observation in the Indian discourse is the relatively low levels of criticism received by the Government. Statements from the Ministry of New and Renewable Energy and NITI Aayog dominate the discourse with minimal opposition from other stakeholders. This asymmetry might stem from the hierarchical nature of Indian energy governance, where the criticism is often informal or subtle, which sometimes may not be seen as a completely polarized statement made by a particular stakeholder.

A second distinction lies in actor diversity and coalition dynamics. Research conducted by Schlund et al., 2022 identifies 49 stakeholder groups in Germany's hydrogen discourse, including utilities, R&D institutions, and infrastructure developers, functioning as information bridges in an early-stage coalition landscape. Even though methodological differences exist, the actor groups generated from this study presents a greater degree of diversity. While the Indian discourse also shows increasing actor diversity over time, it is still disproportionately shaped by industry incumbents and policymakers. NGOs and environmental organizations in Germany play a more pronounced role in voicing equity, sustainability, and justice concerns. Nevertheless, this group remains marginalized. In the Indian case, civil society voices are nearly absent from mainstream media discourse, raising concerns about democratic participation in shaping energy transitions.

Further, the German discourse is more granular in how it evolves thematically across time. Ohlendorf et al., 2023 find that early optimism gives way to emerging tensions, with visible signs of polarization surfacing after 2021, particularly around the production pathways to be taken for establishing the hydrogen economy. These points of friction are less visible in the Indian discourse, which largely presents green hydrogen as a techno-economic opportunity rather than presenting it as a debate requiring critical thought from the actors. However, this thematic convergence in India may be more apparent than real; it is possible that polarizations in the discourse exist but are not published in the data sources due to media biases or strategic ambiguity from actors seeking to preserve plans with respect to business incentives or tactics.

This divergence in contestation is particularly relevant when considering discourse as a mechanism of power and legitimacy. Studies in this domain frequently highlight how actors having a vested interest in green hydrogen solidify their position in the discourse. Ohlendorf et al., 2023 notes that actors usually coalesce their support for green hydrogen in terms of their strategic interests. For actors such as the petrochemical or mobility sectors, Ohlendorf et al., 2023 argue that discourse often reflects path-dependencies and strategic adaptation rather than transformative intent. Similar dynamics are visible in India, where industrial actors repurpose green hydrogen narratives to align with their existing business models or create new verticals to continue their dominance in the business landscape. However, because the discourse is still in its formative phase, there is lesser observations of actors being publicly challenged for such positioning, unlike in Germany, where more mature environmental discourses enable scrutiny.

Finally, on a methodological point of view, the current thesis also uses media sources as a representation of the public discourse, much congruent to the German studies. Yet, the comparative analysis raises a cautionary point: the Indian media landscape, as exemplified by The Times of India and The Economic Times, tends to amplify elite and pro-industry voices. By contrast, studies in Germany often incorporate broader sources which help mitigate over-representation of dominant interests. This difference should inform interpretation and signals an avenue for further research in India.

6.2. Analysis of the Actor Coalitions

The discourse network constructed in this study reveals a landscape marked more by slight tensions related to production pathways for green hydrogen. While the absence of hard polarization may suggest a consensus-driven discourse, a closer analysis of the actor relationships shows the presence of loose, sector-specific coalitions and latent sites of conflict that could become more pronounced as the policy transitions from agenda-setting to implementation.

One of the most visible coalitional patterns in the concepts seeing conflicts is the alignment between central government actors (particularly ministries and national think tank bodies such as NITI Aayog) and large industrial conglomerates. This grouping consistently highlights that themes such as economic opportunity, India's leadership potential, and domestic capacity building in electrolyser production is imperative for the involved actors. Shared optimism about green hydrogen's scalability, combined with calls for supportive policy ecosystems, suggests a coalition rooted in techno-economic strategies where both state and market actors align to promote green hydrogen as a means to assert economic sovereignty and reduce energy import dependence. Policy actors and business leaders frequently cite each other in media discourse, and their statements often reinforce each other's positions. For instance, while policymakers highlight the National Green Hydrogen Mission as a blueprint for industrial innovation, industrial actors invoke the same policy framework to justify project investments and demand fiscal incentives. This alignment appears less ideological and more strategic, functioning to attract investment, secure subsidies, and bolster policy legitimacy.

Despite shared narrative frames, most coalitions in the Indian discourse remain loosely connected. Actors from the finance sector sometimes highlight industrial concerns about high costs that currently being incurred by green hydrogen production, but do not consistently make any significant contributions to the discourse. The same is true for state-level policymakers, who although appear consistently in the discourse, fail to make a significant contribution to the discourse. This is particularly significant given the importance of state governments in implementing energy infrastructure, land allocation, and regulatory support. The lack of visible alignment between national and state actors suggests a potential governance gap that may surface in later stages of the hydrogen transition.

Conflicts in the discourse emerge around three main axes: hydrogen production methods, use cases and technical aspects. While actors seldom express outright disagreement, divergence in these concepts is evident in coded statements. For instance, some industry actors and R&D voices advocate transitional reliance on non-green methods of hydrogen production to enable faster ramp-up, while other actors such as policymakers remain confident on direct implementation of green hydrogen as an immediate solution.

Coalitional dynamics evolved over the four identified phases of the discourse. In the early “National Hydrogen Mission” phase, the network was relatively sparse, dominated by government proclamations and a few industrial endorsements. The “National Green Hydrogen Mission Launch” and subsequent “Progress” phases showed increasing actor density, particularly with the entrance of international collaborators, private sector energy developers, and financial stakeholders. Interestingly, this temporal complexity of the network did not significantly expand the diversity of the concepts. Instead, as the discourse matured, the most visible actors became more centralised around a narrow techno-economic narrative. While early phases included scattered critiques about cost, land use, and technological readiness, later phases saw these concerns de-emphasised or diluted by a dominant framing of green hydrogen as a non-negotiable pillar of India’s net-zero future.

A perspective that is consistently absent in the discourse network are grassroots, labour, and environmental justice actors. Although some NGOs appear and raise concerns about lifecycle emissions or social impact, they remain peripheral in both frequency and network centrality. Likewise, actors representing labour unions, agricultural groups, or marginalised communities are virtually absent from the public discourse captured in media sources. Their exclusion suggests that coalition-building around green hydrogen remains elite-driven, with little bottom-up engagement. This lack of inclusive coalitions could have implications for future legitimacy. The absence of cross-sectoral coalitions involving environmental NGOs, trade unions, and subnational governance actors also limits the possibility of broader alliances that could push for equitable and hydrogen development pathway sustainable over the long term.

A critical point to be noted is whether these coalitions formed between the actors are verifiable or not. The coalitions that are reported represent patterns of claim congruence and not verifiable alliances between the involved actors. From the formed coalitions across the phases it can be observed that central governments and the en-

ergy incumbents co-locate around a pro-deployment storyline, while disagreements remain peripheral. This pattern could reflect message discipline during a mission-driven policy push more than stable, strategic blocs. Hence, these clusters are interpreted as discursive alignments under policy momentum, not evidence of binding coalitions with resource pooling, joint lobbying, or coordinated movements in the green hydrogen development. The repeated co-positioning of actors across claims are network shorthands and not organizational pacts.

6.3. Discourse evolution of GH2 across the Phases

The evolution of India's green hydrogen discourse across the four temporal phases reflects the gradual maturation of the policy narrative from aspirational rhetoric to a more complex, sectoral, and technocratic debate. This transition is not merely marked by an increase in the number of actor statements, but by shifts in discursive density, thematic focus, and actor centrality. Each phase reflects distinct dynamics in the way actors interpret green hydrogen's purpose, feasibility, and strategic value.

The first phase of the discourse which was the National Hydrogen Mission, defined around the period up till the announcement of a Hydrogen Mission being planned by the government. This phase was characterized by a relatively small set of actor statements, most of which came from the government actors, industry leaders and actors from the energy sector. This period served as a phase marked with initial ideas, and discussions about establishing green hydrogen as a strong economic contribution to the nation. Statements in this phase were broad in scope, aspirational in tone, and light on technical or institutional detail. There was limited evidence of contestation or critical engagement in this phase. Few actors questioned the feasibility, costs, or social implications of a hydrogen economy. As seen in the actor coalitions, Phase 1 sees an almost negligible presence of conflicts between the actors.

The second phase started with the period in the timeframe following the announcement of the National Hydrogen Mission till the formal announcement of the National Green Hydrogen Mission in 2023. This period witnessed a significant increase in actor engagement, with actors from the finance sector, energy companies, research and think tanks, and the finance sector entering the discourse. Statements increasingly focused on investment prospects, policy clarity, and infrastructure needs. Sectoral references also became more specific, with actors naming target areas like chemicals and fertilisers, heavy transportation, and steel production using green hydrogen. Thematic convergence remained high during this phase as most actors aligned on the necessity and desirability of hydrogen as a clean energy vector along with the presented economic opportunities. However, cracks began to emerge in the form of divergent views on production methods. While some actors advocated transitional methods for hydrogen production, where non-green methods in the short-term are necessary for a clean transition to a completely decarbonized method, others reiterated the importance of staying "exclusively green.", right at the beginning in order to start the transition process with a mindset to decarbonize as soon as possible. Still, this divergence did not result in outright polarization; disagreements were tempered, and the actors seldom challenged one another. Strategic ambiguity continued to serve as a mechanism for holding the narrative coalition together.

In the post-launch progress phase, the discourse became both denser and more differentiated. Actor statements increased markedly, and more nuanced perspectives surfaced on issues of technological readiness, cost competitiveness, and energy system integration. Sub-national voices and international collaborators started to appear, although they remained peripheral to the core network. Comparing with the findings of Ohlendorf et al., 2023 and Belova et al., 2023, a lesser degree of polarization can be observed than these studies as the discourse matures. Importantly, this phase saw a shift in tone from uncritical celebration to cautious realism. Actors began referencing obstacles such high costs, energy efficiency, and challenges in aligning state-level policy frameworks. Moreover, subtle forms of contestation became more visible in this phase on production pathways and technical aspects of the viability of green hydrogen.

By the most recent phase, the discourse had become deeply institutionalised, but also risked entering a stage of strategic drift. While the number of statements reached a peak that suggests high engagement of actors, the diversity of claims can be seen declining. The narrative increasingly centred on implementation timelines, pilot project announcements, and reiteration of the already presented economic opportunities. Fewer actors introduced any new variations to the discourse or any critical feedback in the discourse. Simultaneously, some early-stage concern such as environmental concerns highlighted by some actors see a negligible presence in the discourse. This indicates a convergence in discourse, but not necessarily in consensus. The disappearance of dissenting views may reflect media selection bias, or elite agenda control in the media discourse, rather than actual resolution of disagreements.

Across all four phases studied in this thesis, India's hydrogen discourse has not exhibited strong polarization that can be seen and understood as the presence of strongly opposed coalitions of the actors. Conflicting interests remain embedded within the discourse, but they are masked by a shared reliance on vague or flexible framing such as "green hydrogen" as a placeholder for multiple, sometimes contradictory, production visions. Convergence has thus emerged through strategic intent. Actors repeat similar talking points to signal support, gain legitimacy, or avoid exclusion from policy and funding opportunities. However, such convergence is structurally fragile. Without mechanisms for mediating conflicts on production pathways, trade justice, and inter-sectoral competition, these micro-narratives may eventually fracture as material stakes rise.

Anchoring phases to major policy moments exposed a repeatable sequencing pattern: early agenda-unity (Phase 1), expansion plus specification (Phase 2), peak contestation during consolidation (Phase 3), and re-centralization after fiscal anchoring (Phase 4). This sequence would have been largely invisible in a single static network because the same actors recur while their linking claims rotate. The policy-triggered cuts thus serve as a microscope for narrative shifts, showing when investment talk overpowers feasibility concerns, and when sectoral prioritization (e.g., steel, fertilizers, heavy transport) supplants generic ambition.

The discourse is also dominated by Editorial coupling, where outlets prioritize "announceables" (MoUs, tenders, budget lines), sidelining slower, complex issues (water,

grid, land) unless tied to a fresh event. Technical expertise from the research and scientific community was gated where technical or justice-oriented claims travel through a small epistemic community and these claims are not routinely quoted. A level of agenda overshadowing was also seen in the export/leadership narratives, where relevant claims crowd out nuanced opinions, once fiscal and diplomatic signals arrive. The observed late-phase drop in environmental or distributional claims is therefore better explained by selection and timing than by genuine resolution.

The chosen phasing provided us with knowledge that a static flat analysis could not. First, contestation peaks mid-stream when targets and roles are assigned, not at inception; second, that message discipline returns once investments and delivery frames dominate; third, that apparent consensus coexists with shrinking claim diversity, a tell-tale of agenda control rather than problem closure. These are actionable insights for policymakers: if you want informed contestation (and better design), create institutional venues and media hooks in late phases where feasibility, sequencing, and verification claims can compete with rollout headlines.

6.4. Methodological Reflections for DNA

This thesis engages with discourse theory, transition studies, and network approaches to explain how actors shape, stabilize, or contest emerging narratives around green hydrogen in India. The empirical findings extend, nuance, and, in some cases, complicate the assumptions embedded in these frameworks.

Using mainstream newspaper articles as the observation arena is defensible for a longitudinal DNA but in India it systematically privileges elite voices and center-led narratives. National English-language outlets under-sample state governments, vernacular and regional media, trade press, and grassroots actors. Quotations often originate in ministry or PSU sessions, project MoU ceremonies, or sponsored events. This can overstate consensus and understate distributional or local-impact frames. Newspaper articles provide a good lens on agenda-setting but a rather poor lens on contestation analysis. The bias was partly mitigated by coding across four phases and multiple outlet types, but a fuller Indian picture would also include data triangulations from parliamentary committee minutes, consultation submissions, tender documents, and regional language reporting, and explicitly weight source types in the network to reduce media salience bias. Another triangulation source that can be included for further studies can be expert interviews.

Drawing from Hajer's conceptualisation of discourse as "an ensemble of ideas, concepts and categories reproduced through identifiable sets of practices" Hajer, 1993, 2006, the findings confirm that India's green hydrogen discourse is not simply a neutral reflection of technological potential. Instead, it constitutes a platform where actors mobilize language to frame hydrogen as a vehicle for growth, energy security, geopolitical prestige and mainly, portraying India as an economic superpower. These storylines, particularly those around techno-economic narratives and energy independence serve to construct hydrogen as a non-negotiable pathway for the targets set thereby limiting the discursive space available for more critical or justice-oriented framings.

Hajer, 2006 shares a concept of "discourse coalitions" that ties actor groupings to-

gether not by formal coordination but by shared concepts can be seen in this case. For instance, the alignment between central government agencies, industrial actors, and financiers does not rest on formal partnerships but on the incentive shared by these actors in the narrative of achieving growth through hydrogen. However, unlike the adversarial discourse coalitions observed in some European cases, the Indian coalitions appear more as formations of discursive convergence than of narrative competition. This suggests an addition to Hajer's theory: in early-stage technological discourses in high-centrality policy environments, coalitions may emerge not around antagonism but around the mutual avoidance of conflict.

The empirical data also resonate with Snow and Benford, 1988 theory of strategic framing, where actors deliberately emphasise or downplay elements of a narrative to align with their interests. In the Indian case, this can be seen as a flexible invocation of "green hydrogen," and in most cases there is no clarification whether the term refers exclusively to electrolysis of water powered by renewable energy or includes transitional reliance on hybrid grids or blue hydrogen. Such ambiguity enables actors with divergent agendas to project alignment without committing to polarized sides of the debates.

However, what the Indian case adds to this debate is an observation of non-confrontational setting of discourse, as mentioned before. Unlike fossil fuel lobbies openly resisting renewable energy transitions in different part of the world, Indian industrial actors frame themselves as hydrogen champions. In terms of network theory, the findings solidify Leifeld, 2017's proposition that discourse networks are useful not only for mapping actor positions but for identifying structural inequalities in narrative influence. The centrality of industrial and policy actors in the network, both in terms of frequency and co-occurrence with dominant concepts illustrates how discursive legitimacy is unequally distributed. Peripheral actors, such as NGOs or state governments, may introduce alternative narratives to the debate, but these rarely offer substantial amount of contribution in the debate to alter the structure of discourse coalitions.

The use of Discourse Network Analysis (DNA) in this study contributes to methodological innovation in the Indian policy research landscape. It provides a systematic way to operationalise complex narrative structures, actor alignments, and thematic evolution across time. It also allows for quantifiable tracking of discourse intensity, actor centrality, and shifts in coalition strength, and provides an empirical grounding for theories of discourse and power. Moreover, the ability presented by the Discourse Network Analyser software allows for the export of network maps into Visone, providing a detailed insight into the interaction in a detailed manner using discourse maps (Leifeld, 2024).

Nevertheless, the study observes a few gaps for DNA being a suitable tool to study stakeholder perspectives for a socio-technical transition context, and that for a country like India. DNA is well-suited to reveal who says what with whom over time, but it cannot, on its own, establish coalition intent, resource exchange, or causal influence. Dividing the study in four phases helps, yet network structure can remain shallow in periods of agenda unity. In comparative work on Germany, discursive clustering and centralization varied by "event" vs "consolidation" phases, with economic actors often dominant—reminding us that low modularity can reflect phase-specific agenda

setting rather than durable coalitions (Belova et al., 2023). Hence for India, DNA is more suitable as a coalition hypothesis generator, to be tested via expert interviews, document tracing, and event-based co-mobilization evidence.

6.5. Limitations and Future Research

While this study offers a structured and novel view of India's green hydrogen discourse using Discourse Network Analysis (DNA), several methodological limitations must be acknowledged, particularly in framing of the discourse.

The data source selection restricts the study to articles from The Times Group introduces a systematic bias toward elite, technocratic, and pro-industry perspectives. These newspapers tend to foreground voices from policymakers, large industrial corporations, and international investors. Due to this limitation, there can be seen an underrepresentation of marginalized actors such as NGOs. Realistic perspectives from such actors are needed to discourage a skewed interpretation of the results. Consequently, the network constructed reflects the dominant public-facing discourse which in itself has been shaped by the dominant actors in the discourse, but not necessarily the full spectrum of stakeholder narratives, particularly those critical of hydrogen transitions or the social acceptance aspect of green hydrogen. Furthermore, the discourse is analyzed through the lens of text-based sources published in the english language. In a country such as India, there are a lot more insights that can be uncovered from regional language newspapers, visual mediums of news reporting, and discourse from the social media platforms. Inclusion of these data sources may present a very different discourse landscape, if analysed on a regional level.

The media-mediated nature of discourse implies that actors' positions are captured only when publicly articulated, or captured by the contribution of journalists. Many institutional actors from state-level agencies, research and think tank groups, or NGOs may have internalised views or provided concerns that do not show up in public media. As a result, absence of these perspectives in the discourse network does not mean that the perspectives do not exist in the discourse landscape.

Also, the use of manual inductive coding introduces an interpretive layer in assigning codes and stances to actor statements from the researchers end. Although coding decisions were guided by consistency and iterative refinement, subjective judgments in interpreting tone or intent can affect categorisation, particularly in cases where statements were ambiguous. Even though the temporal segmentation enabled phase-wise analysis of discourse evolution, it did not allow for analysing real-time shifts in actor positions. The network treats actor statements as static within each phase, which limits the ability to trace changes within the actor perspectives or strategic repositioning in response to external developments such as economic developments or geopolitical concerns.

A reflection on whether a different methodology was involved in this study (e.g. expert interviews) is also necessary. The media corpus captures publicly articulated positions; it misses views that are strategic, premature, or politically costly to air. In India's mainstream, English-language press, elite and pro-industry voices dominate and many sub-national and civil society perspectives never surface. Interviews coun-

terbalance this by recovering positions that are absent from print and distinguishing messaging from belief. Interviews can therefore act as a corrective measure and advocate for the media forum bias introduced in this study.

In the Indian context, interviews are not a future add-on but rather are the necessary second leg of inference for the green hydrogen discourse. They would almost certainly reduce the measured consensus, surface dormant divergences (especially centre–state and sectoral sequencing), and convert the current "discursive alignments" into testable coalition claims tied to real decisions. If those shifts do not appear even after careful interviewing, that negative finding would itself be powerful evidence that India's hydrogen discourse is unusually centralised by design rather than by data artefact.

Despite these limitations, the methodological design remains fit for purpose: it captures the dominant structure of India's green hydrogen discourse, highlights the asymmetries in narrative influence, and provides a replicable framework for comparative studies. Nonetheless, future work could benefit from incorporating broader media sources, triangulating with interviews or policy documents, and integrating perspectives from sub-national and civil society actors to present a more inclusive and contested discursive field. Incorporation of regional media in different languages across the country is an avenue that presents an opportunity for further interesting insights about the green hydrogen discourse. Also, in an internet-savvy country like India, social media platforms presents a huge opportunity to capture discourse dynamics in different types of actors that might not even be present in legacy media sources. A slightly different path for research is also establishing the link between policy and discourse outcomes. A quantitative approach to study the effect of discourse evolutions on policy changes, funding decisions is something that is needed to validate the economic growth presented by green hydrogen.

7

Conclusion

This thesis set out to examine how the discourse around green hydrogen in India has unfolded in the public domain since 2020. Using Discourse Network Analysis (DNA) as a methodological framework, the study analysed over 316 newspaper articles from two leading national dailies to trace the evolution of ideas, actors, and alliances. By coding claims made by stakeholders and visualising their co-occurrence across four temporal phases, the research aimed to uncover the structure of narratives, the alignment and divergence of actors, and the ways in which emerging coalitions shape the trajectory of India's green hydrogen ambitions. Situated within broader transitions and discourse theory, the study contributes to our understanding of how public discourse both reflects and constructs the early-stage politics of energy innovation in a rapidly developing economy.

By looking at the sub-research questions that were posed earlier in the study, the main-research question: **"How has the discourse of hydrogen evolved among the Indian actors since 2020?"**, is answered.

What are the key concepts discussed in the mainstream media regarding green hydrogen in India?

It can be seen tha the discourse around green hydrogen contains a set of recurring concepts that reflect both national ambitions and sector-wise perspectives. Dominant concepts mainly include economic opportunities, energy independence, and India's potential leadership in global green hydrogen markets. These are complemented by discussions around production methods of hydrogen (Exclusively green vs non-green methods), use cases across different domains (particularly in steel, chemical and fertilisers, and transport), and geopolitical or international partnerships for hydrogen imports.

Over time, the conceptual scope has shifted. Early narratives were predominantly representing ambitions and projecting hydrogen as a transformative solution. Later phases introduced more technical concerns, including cost competitiveness, domestic manufacturing of equipment and machinery, and the design of public policy frameworks. Nevertheless, some concepts such as environmental concerns, land-use im-

pacts, or regional-level perspectives remain almost negligible or absent from mainstream narratives.

Who are the key actors involved in India's green hydrogen discourse?

The discourse is dominated by a narrow set of powerful actors, primarily central government agencies, actors from the energy sectors: both public and private organizations, industrial conglomerates, and research and think tank institutions. These actors not only appear most frequently but also occupy central positions in the network, reinforcing each other's narratives and lending coherence to the dominant storyline.

Over time, research institutions and technology developers have become more active, particularly in later phases as the discourse shifted toward implementation. However, NGOs and environmental-concerned group of actors remain largely absent or peripheral. Their underrepresentation raises concerns about the inclusiveness and accountability of the policy debate, especially as hydrogen infrastructure begins to take material shape with on ground implementation of projects across the country.

What are the stances taken by key actors involved in green hydrogen initiatives in India?

Most actors express strong support for establishing a green hydrogen economy in India, framing it as a national priority and an economic opportunity that cannot be missed. However, this apparent alignment conceals significant differences in concepts related to production pathways. Some actors advocate for the use of exclusively green hydrogen, produced via renewable energy enabled electrolysis, while others support transitional use of non-green hydrogen to support a easier degree of implementation in the long-term. Similarly, while some stress hydrogen's potential in hard-to-abate sectors, others promote a broader range of applications, including heavy transportation and maritime.

Despite these differences, a negligible number of actors adopt openly divergent positions. Instead, the discourse constitutes of strategic ambiguity, especially in how actors frame terms or concepts. Hence the resulting discourse allows for a broad coalition to persist, even as underlying interests diverge.

How do actors interact within the discourse network?

The network reveals the formation of loose but effective coalitions, particularly between policymakers, industrial actors and actors from the energy sector. These actors share a techno-economic understanding of hydrogen, advocate for policy support mechanisms, and reinforce the legitimacy of other incumbent actors in public discourse. Their interaction suggests a model of state–market alignment, oriented toward project delivery and global competitiveness. However, the discourse shows limited evidence of polarized coalitions or structured opposition. Conflict remains largely latent, with dissenting voices often marginalised rather than contested. Peripheral actors, particularly NGOs or environmental critics (which are effectively absent from the discourse) seldom raise concerns about resource use or equity but rarely achieve a substantial degree of centrality in the discourse. As such, the current structure reflects a cohesion that faces the risks of conflicts arising in future timeframes as implemen-

tation challenges arise.

How has the discourse around green hydrogen evolved in India since 2020?

The discourse has evolved from an initial ideation phase into a multi-actor and a multi-sector debate with multiple perspectives. In the early phase, following the announcement of the National Hydrogen Mission, the narrative was defined by aspirational language around energy independence and global leadership. As policy milestones progressed, particularly with the National Green Hydrogen Mission in 2023, the discourse expanded both in actor diversity and on a conceptual level. Industry actors, financial institutions, and research and think tank increasingly shaped the conversation, shifting the focus to investment mechanisms, feasibility, and production technologies.

Taken together, the findings indicate a pattern of strategic convergence: while disagreements on production methods, end-uses and technical feasibility exist, they are usually framed in vague or non-confrontational terms. The result is a discourse that appears unified yet contains latent conflicts likely to surface as projects move from announcements to delivery, raising the risk of missed targets. This trajectory, early discursive consolidation followed by issue differentiation—is consistent with many early, stage transitions. Against this backdrop, the thesis concludes that public discussion is aligned on ambition but unsettled on design. Using Discourse Network Analysis, the study shows how central government and energy-sector incumbents cluster to sustain a dominant, pro-deployment storyline, while quieter cautionary positions remain peripheral. As policy shifts from goal setting to concrete decisions, choices about what counts as “green,” the sequencing of end-uses and the respective roles of central and state institutions should be made openly and on clear evidence. Practically, this means making trade-offs explicit, broadening participation in decision-making and linking incentives to verifiable outcomes—steps that would help translate national ambition into implementation that is technically sound, economically sensible and publicly credible.

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A

Appendix

Table A.1: Deductive Codebook (Ohlendorf et al., 2023)

Code Group	Codes
Climate Change Mitigation	• Important for energy transition • Required for complete decarbonization • Prioritize other climate mitigation options
Economic Considerations	• Economic opportunities • Eventually cheap option • Generally scarce and expensive
Technical Aspects	• Utilization of existing gas grid • Facilitates renewable integration • Low energy efficiency
Use	• Wide use • Restricted use
Production Method	• Non-green necessary • Exclusively green
Imports	• Imports beneficial • Imports concerning

B

Appendix

Table B.1: List of New Codes with Categories

Code group	Code
Economic Considerations	• Currently expensive • International partnerships necessary for GH_2 ramp-up • Hydrogen certification for global trade • Developed countries to incentivize emerging economies for GH_2
General Statements	• Policy subsidies/incentives needed • India has effective policy for GH_2 • Public education on GH_2 necessary • Hydrogen technology seeing good progress • Mandate for GH_2 made in India • Local demand for GH_2 increasing • State-level implementation for GH_2 • Energy independence for India • Support for NGHM • India is an early mover of GH_2 • India needs to prioritise safety in GH_2 production

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Code group	Code
Production Method	• India has promising production targets • GH_2 production from biomass • Solid-state hydrogen production method • GH_2 production from seawater
Technical Aspects	• Hydrogen is easy to transport
Use / Use Cases	• Chemicals and fertilizers • Transportation • Energy carrier • Aviation • Maritime • Passenger cars • Steel industry • Cement industry • Sugar industry • Military • Railways
Exports	• India can export GH_2

C

Appendix

Table C.1: List of Coded Statements with Categories

Code ID	Statements	Category
CM1	CM1: Important for energy transition	Climate Mitigation
CM2	CM2: Prioritize other climate mitigation options	Climate Mitigation
CM3	CM3: Required for complete decarbonization	Climate Mitigation
E1	E1: Currently expensive	Economic Ramp-up
E2	E2: Economic opportunities	Economic Ramp-up
E3	E3: Eventually a cheap option	Economic Ramp-up
E4	E4: International Partnerships necessary for GH2 rampup	Economic Ramp-up
E5	E5: Hydrogen Certification for global trade	Economic Ramp-up
E6	E6: Developed countries to incentivize emerging economies for GH2	Economic Ramp-up
G1	G1: Policy subsidies/incentives needed	General Statements
G2	G2: India has effective policy for GH2	General Statements
G3	G3: Public education on GH2 necessary	General Statements
G4	G4: Hydrogen technology seeing good progress	General Statements
G5	G5: Mandate for GH2 made in India	General Statements
G6	G6: Local demand for GH2 increasing	General Statements
G7	G7: State-level implementation for GH2	General Statements
G8	G8: Energy independence for India	General Statements
G9	G9: Support for NGHM	General Statements
G10	G10: India is an early mover of GH2	General Statements
G11	G11: India needs to prioritise safety in GH2 production	General Statements

Continued on next page

Code ID	Statements	Category
I1	I1: Imports beneficial	Imports
I2	I2: Imports concerning	Imports
P1	P1: Exclusively green	Production Methods
P2	P2: Non-green necessary	Production Methods
P3	P3: India has promising production targets	Production Methods
P4	P4: GH2 production from Biomass	Production Methods
P5	P5: Solid-state hydrogen production method	Production Methods
P6	P6: GH2 production from Seawater	Production Methods
T1	T1: Facilitates renewable integration	Technical Aspects
T2	T2: Low energy efficiency	Technical Aspects
T3	T3: Utilization of existing gas grid	Technical Aspects
T4	T4: Hydrogen is easy to transport	Technical Aspects
U1	U1: Restricted Use	Use Case
U2	U2: Wide use	Use Case
U3	U3: Chemicals and Fertilizers	Use Case
U4	U4: Transportation	Use Case
U5	U5: Energy carrier	Use Case
U6	U6: Aviation	Use Case
U7	U7: Maritime	Use Case
U8	U8: Passenger Cars	Use Case
U9	U9: Steel industry	Use Case
U10	U10: Cement Industry	Use Case
U11	U11: Sugar industry	Use Case
U12	U12: Military	Use Case
U13	U13: Railways	Use Case
X1	X1: India can export GH2	Exports

D

Appendix

Table D.1: List of Actors and Their Sectors Used in the Discourse

Sr No	Actor Name	Sector
1	ACME Group	Energy Sector
2	AM Green	Energy Sector
3	Advait Infratech	Energy Sector
4	Amp Energy	Energy Sector
5	Amplus Solar	Energy Sector
6	Apraava Energy	Energy Sector
7	Avaada Energy	Energy Sector
8	Bharat Petroleum Corporation Limited	Energy Sector
9	Chennai Petroleum Corporation Limited	Energy Sector
10	EKI Energy Services	Energy Sector
11	Fortescue Future Industries Pvt Ltd	Energy Sector
12	GAIL	Energy Sector
13	Gentari Renewables India	Energy Sector
14	Green Power International	Energy Sector
15	Greenko	Energy Sector
16	Greenzo Energy	Energy Sector
17	H2E Power	Energy Sector
18	Hartek Power	Energy Sector
19	IEA	Energy Sector
20	India Hydrogen Alliance	Energy Sector
21	Indian Oil Corporation	Energy Sector
22	Indian Renewable Energy Development Agency Limited	Energy Sector

Continued on next page

Code ID	Statements	Category
23	International Energy Agency	Energy Sector
24	Jakson Green	Energy Sector
25	Keppel Infrastructure	Energy Sector
26	McPhy	Energy Sector
27	NTPC	Energy Sector
28	Nawgati	Energy Sector
29	Newtrace	Energy Sector
30	ONGC	Energy Sector
31	Ohmium International	Energy Sector
32	Oil India Limited	Energy Sector
33	Rajasthan Renewable Energy Corporation Limited	Energy Sector
34	ReNew Power	Energy Sector
35	SJVN Green	Energy Sector
36	Semcorp Industries	Energy Sector
37	Spirare	Energy Sector
38	Technip Energies	Energy Sector
39	The Energy Company	Energy Sector
40	Thermax	Energy Sector
41	Torrent Power	Energy Sector
42	Aavishkaar Capital	Finance
43	Avendus Capital	Finance
44	Bank of America	Finance
45	Guidance Tamil Nadu	Finance
46	HDFC Securities	Finance
47	HSBC India	Finance
48	ICRA	Finance
49	Morgan Stanley	Finance
50	New Development Bank	Finance
51	State Bank of India	Finance
52	World Bank India	Finance
53	A.P. Moller	Industry
54	Adani Group	Industry
55	ArlecorMittal Nippon Steel India	Industry
56	Avalon Consulting	Industry
57	Ballard Power Systems	Industry
58	Bernstein Group	Industry

Continued on next page

Code ID	Statements	Category
59	Capgemini	Industry
60	Chennai Port Trust	Industry
61	DP World	Industry
62	Deendayal Port Authority	Industry
63	EY India Mining and Metals	Industry
64	Environmental Resources Management Corporation	Industry
65	Essar Group	Industry
66	Independent Consultant	Industry
67	JSW Group	Industry
68	John Cockerill	Industry
69	KPMG	Industry
70	Kearney India	Industry
71	Larsen & Toubro	Industry
72	Linde	Industry
73	National Sugar Institute	Industry
74	Patton	Industry
75	Primus Partners	Industry
76	RBM Infracon	Industry
77	Reliance Industries Limited	Industry
78	Tata Steel	Industry
79	Thyssenkrupp	Industry
80	Total Energies	Industry
81	V O Chidambaranar Port Authority	Industry
82	Vedanta Limited	Industry
83	Welspun Group	Industry
84	Asia Society Policy Institute	NGO
85	Confederation of Indian Industry (CII)	NGO
86	Global Energy Alliance for People and Planet	NGO
87	Global Wind Energy Council	NGO
88	Independent Green Hydrogen Association	NGO
89	World Wind Energy Association	NGO
90	Andhra Pradesh State Government	Policymaker
91	Assam State Government	Policymaker
92	Department of Science and Technology	Policymaker
93	Energy Transition Advisory Committee	Policymaker
94	European Commission	Policymaker

Continued on next page

Code ID	Statements	Category
95	European Union Embassy	Policymaker
96	General Authority for Investment and Free Zones Egypt	Policymaker
97	Goa State Government	Policymaker
98	Government of Egypt	Policymaker
99	Government of France	Policymaker
100	Government of India	Policymaker
101	Government of Norway	Policymaker
102	Government of Saudi Arabia	Policymaker
103	Government of South Korea	Policymaker
104	Government of United States of America	Policymaker
105	Gujarat State Government	Policymaker
106	Himachal Pradesh State Government	Policymaker
107	Karnataka State Government	Policymaker
108	Ministry of External Affairs	Policymaker
109	Ministry of New and Renewable Energy	Policymaker
110	Ministry of Petroleum	Policymaker
111	Ministry of Ports, Shipping and Waterways	Policymaker
112	Ministry of Power	Policymaker
113	New Town Kolkata Authority	Policymaker
114	Odisha State Government	Policymaker
115	Punjab State Government	Policymaker
116	Punjab State Government	Policymaker
117	Rajasthan State Government	Policymaker
118	Tamil Nadu State Government	Policymaker
119	UN Environment Programme	Policymaker
120	Union Ministry of Road and Transport	Policymaker
121	Uttar Pradesh State Government	Policymaker
122	West Bengal State Government	Policymaker
123	Council on Energy, Environment and Water	Research and Think Tank
124	BioCyTih - Bits Pilani	Research and Think Tank
125	Birla Institute of Technology and Science	Research and Think Tank
126	Electric Power Research Institute	Research and Think Tank

Continued on next page

Code ID	Statements	Category
127	Global Efficiency Intelligence	Research and Think Tank
128	Gujurat Energy Research and Management Institute	Research and Think Tank
129	Indian Council for Research on International Economic Priorities	Research and Think Tank
130	Indian Institute of Science	Research and Think Tank
131	Indian Institute of Technology Bhilaii	Research and Think Tank
132	Indian Institute of Technology Delhi	Research and Think Tank
133	Indian Institute of Technology Indore	Research and Think Tank
134	Institute of Energy Economics and Financial Analysis	Research and Think Tank
135	International Symposium on Hydrogen in Matter	Research and Think Tank
136	NITI Aayog	Research and Think Tank
137	NITK Surathkal	Research and Think Tank
138	Nomura Research Institute Consulting	Research and Think Tank
139	Nuvama Research	Research and Think Tank
140	Pandit Deendayal Energy University	Research and Think Tank
141	Rajiv Gandhi Institute of Petroleum Technology	Research and Think Tank
142	StockSelect Equitymaster Agora Research Limited	Research and Think Tank
143	The Energy and Resources Institute	Research and Think Tank
144	World Resources Institute	Research and Think Tank
145	Altigreen	Transport Sector
146	Ashok Leyland	Transport Sector
147	Erisha E Mobility	Transport Sector
148	Hero Group	Transport Sector

Continued on next page

Code ID	Statements	Category
149	Zeroavia	Transport Sector

E

Appendix

Table E.1: Newspaper Articles Used in the Discourse

Sr No	Newspaper Title	Date
1	Emerging economies need to step up investment, especially in technology: BofA chief strategist	27-10-2020
2	Stepping on the gas with Ujjwala, hydrogen mission	02-02-2021
3	India will conduct auctions for green hydrogen in next 3-4 months: R K Singh	20-02-2021
4	ACME , Tatweer to invest $2.5 billion to set up Green Ammonia unit in Oman	24-03-2021
5	RIL 44th AGM: Here's the full text of Mukesh Ambani's speech	25-06-2021
6	NTPC REL to setup first green Hydrogen mobility project in Ladakh	14-07-2021
7	JSW Energy in agreement with Australian firm for Green Hydrogen	30-07-2021
8	Soon, green H2 must for refineries	07-08-2021
9	Green hydrogen purchase to count as RPO: Power Ministry draft rules	17-08-2021
10	ACME Group signs land deal for green ammonia project in Oman	24-08-2021
11	Mukesh Ambani promises a 'Jio' for energy transition	04-09-2021
12	Green hydrogen central to fight against climate change	05-09-2021
13	5 GW electrolyser capacity on cards for green hydrogen	14-09-2021
14	Why aren't energy PSUs at the forefront of India 's energy transition?	29-09-2021

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15	RIL's entry could give a boost to green hydrogen industry: H2E Power CEO Siddharth R Mayur	06-10-2021
16	NTPC, Gujarat Gas to blend hydrogen for CGD networks	10-10-2021
17	Gautam Adani aims to be one of the largest green hydrogen producers in the world: Gautam Adani	20-10-2021
18	View: The centrality of hydrogen initiative in GoI's plan to 'decarbonise the economy'	20-10-2021
19	How India can become a leader in production and export of green hydrogen	23-10-2021
20	Why hydrogen could finally be petrol of the future	26-10-2021
21	Adani Enterprises in talks for $2-bn mega fundraise	29-10-2021
22	BPCL Green Hydrogen unit to be India 's Largest	24-11-2021
23	India Committed to 2070 Target	26-11-2021
24	L&T Inks Green Hydrogen Pact with ReNew Power	03-12-2021
25	Greenko Arm, John Cockerill Ink Pact for Electrolyser Unit	08-12-2021
26	Govt to spell out hydrogen policy soon	21-12-2021
27	Top Metal Companies Helping India Achieve Net-Zero Emissions by 2070	30-12-2021
28	Oil Cos Already Preparing Plans'	31-12-2021
29	Panel formed to prepare energy transition roadmap for India	01-01-2022
30	IPICOL -GAIL join hands for clean energy	07-01-2022
31	Thyssenkrupp has H 2Plans for India	10-01-2022
32	Going Green: How India can gradually shift to renewable energy	18-01-2022
33	Clean, Green and Go! A Budget needed for India 's historic energy transition	01-02-2022
34	Are FM's clean energy, EV announcements in line with India 's climate commitments? Experts weigh in	02-02-2022
35	New Policy to Exempt Green Hydrogen Firms from Transmission Charges	17-02-2022
36	Govt targets 5 MT green hydrogen; waives RE transmission charges for makers for 25 years	18-02-2022
37	Hydrogen policy offers 25-year transmission fee waiver for green power	19-02-2022
38	Adani Group, Ballard Power sign MoU for hydrogen fuel cell JV	22-02-2022
39	Stocks in the news: NTPC, IndiGo, GMDC , Hinduja Global and Federal Bank	22-02-2022

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40	What India should do to become a leader in green hydrogen	01-03-2022
41	PM Narendra Modi to address Renewable Energy players on initiatives in energy resources	04-03-2022
42	Government may give PLI-like sops for hydrogen, ammonia	14-03-2022
43	India Aims to Become Energy Exporter	17-03-2022
44	All you need to know about India 's first hydrogen-powered fuel cell electric car project	18-03-2022
45	India & Oman to focus on space, mining, maritime & S&T sectors to upgrade ties	24-03-2022
46	Six renewable energy companies float green hydrogen advocacy group	29-03-2022
47	Indian Oil, L&T, ReNew Join Hands for Green H2 Joint Venture Fuel Prices Rise 40 Paise	05-04-2022
48	Former UN Environment Programme executive director sees a solar opportunity for in TN	09-04-2022
49	How India can position itself as a low-cost, zero-carbon green hydrogen manufacturing hub	10-04-2022
50	GREENING THE GIGAWATTS	10-04-2022
51	Oil India Limited commissions India 's first 99.999% pure Green Hydrogen pilot plant	21-04-2022
52	Linde investing big on hydrogen, but cost-effective green hydrogen still 5–7 years away, says CEO	21-04-2022
53	Hydrogen to be 10% of RIL 's earnings by 2030, $10 billion in value: Morgan Stanley	22-04-2022
54	Indo- German green hydrogen task force set up for climate action goals	03-05-2022
55	Surge in commodity prices may delay India 's hydrogen consumption goals: ICRA	06-05-2022
56	NITK project aims at producing green hydrogen from seawater	09-05-2022
57	India , EU eye deeper cooperation on green hydrogen	04-06-2022
58	NTPC awards Amara Raja Group India 's first green hydrogen fueling station project	14-06-2022
59	View: Green energy open access rules 2022 is a good start	14-06-2022
60	Total to take 25% in Adani 's $50 billion green hydrogen game	15-06-2022
61	Adani & French TotalEnergies tie-up to create 'world's largest green hydrogen ecosystem	15-06-2022
62	Niti Aayog bats for setting up of green hydrogen corridors	30-06-2022

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64	ACME Group announces Rs 52,474 crore green hydrogen plant in Tamil Nadu	06-07-2022
65	Green Hydrogen: What is green hydrogen, why Reliance and Adani Group are investing in it, and other queries	10-07-2022
66	IISc team claims tech to generate green hydrogen from biomass	13-07-2022
67	Adanis Hope to Reshape India 's Energy Footprint; to Bet $70-b in Green Power	27-07-2022
68	ONGC inks MoU with Greenko to manufacture green hydrogen	28-07-2022
69	India and Egypt sign MoU to set up a green hydrogen plant with investments of $8 billion	29-07-2022
70	PM greets IPDS beneficiary with 'Har Har Mahadev'	01-08-2022
71	Ohmium and Spirare Energy collaborate with NTPC for green hydrogen	06-08-2022
72	Renewable energy stocks good bets for long term	08-08-2022
73	4 renewable energy stocks that are good long-term bets	09-08-2022
74	L&T commissions its first green hydrogen plant at Hazira	21-08-2022
75	L&T Draws up a $2.5-billion Green Energy Plan	22-08-2022
76	Indian Oil Corp eyes net zero carbon emissions by 2046	26-08-2022
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78	Green Hydrogen Fuel: An opportunity for India to achieve Net Zero	14-09-2022
79	India should be the hub for compact EV manufacturing: Kant	27-09-2022
80	We plan to be a 30 GW company by 2030: Vineet Mittal	30-09-2022
61	Adani & French TotalEnergies tie-up to create 'world's largest green hydrogen ecosystem	15-06-2022
62	Niti Aayog bats for setting up of green hydrogen corridors	30-06-2022
63	Future lies in technological disruption: Amitabh Kant, CEO Niti Aayog	01-07-2022
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79	India should be the hub for compact EV manufacturing: Kant	27-09-2022
80	We plan to be a 30 GW company by 2030: Vineet Mittal	30-09-2022
81	Amp Energy India and Ohmium collaborate on 400MW of green hydrogen	01-10-2022
82	Banks for including electric vehicles, green hydrogen in priority lending	11-10-2022
83	A G20 agenda for Climate Leadership	14-10-2022
84	Hydrogen-powered Toyota Mirai test mule in India : Highlights	16-10-2022
85	Keppel Infra, Greenko Join Hands to Explore Green Energy Options Here	26-10-2022
86	Jakson group to set up mega green hydrogen & ammonia plant in Kota	28-10-2022
87	India releases long-term strategy to reach net zero goal	16-11-2022
88	Bad news equals a good stock price & dividend yield – Indian Oil corporation fits the bill	25-11-2022
89	Alternative energy: IOC to set up new company for green business	01-12-2022
90	Partnership Details Being Finalised	08-12-2022
91	Reliance , Ashok Leyland in talks for engines running on H2	09-12-2022
92	House Nod for Bill Fostering Green Energy, Carbon Trading	13-12-2022

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94	Granules India Signs Pact with Greenko ZeroC for Green Molecule Solutions	04-01-2023
95	Government approves Rs 19,744 crore National Green Hydrogen Mission	05-01-2023
96	Central Panel Likely to Decide Minimum Green H2 Purchases	05-01-2023
97	Developed nations' huge green hydrogen sops a challenge for India , says Minister RK Singh	06-01-2023
98	Explained: What is green hydrogen and India 's national mission to cut emissions ?	06-01-2023
99	CAD, Green Hydrogen & growth are top 3 objectives of FM in Budget 2023: Anita Gandhi	15-01-2023
100	Green hydrogen: In 3 years, pacts worth Rs 2.5 lakh crore inked in Karnataka	17-01-2023
101	Adani Enterprises to deploy hydrogen-powered trucks	18-01-2023
102	Decarbonizing India 's steel sector: opportunities and challenges	31-01-2023
103	Budget 2023 will promote green growth, says renewable industry	02-02-2023
104	Budget 2023: Does it move the needle enough for the green energy sector?	05-02-2023
105	Shift to EVs get priority with fair allocation	06-02-2023
106	View: Budget ensures 'clean & green' becomes vehicle for growth	06-02-2023
107	Adani vs Hindenburg saga: 10 things which have happened so far	14-02-2023
108	Punjab seeks Centre's help for setting up 100 MW biomass power projects	15-02-2023
109	A more sustainable mix: Different shades of green will meet India 's energy needs	18-02-2023
110	India perfectly situated to join Europe's green hydrogen supply chain: Stefan Kaufmann	20-02-2023
111	India 's green energy potential no less than a goldmine, says PM	25-02-2023
112	The future is renewables: Transit fast but smarter	26-02-2023
113	Essar floats transition arm with $3.6bn India , UK plans	01-03-2023
114	Greenko to Raise $700 m via Rights Issue, Values Co at $7 b	03-03-2023
115	Green H2 Mission Norms, Tender by FY24 First Half	06-03-2023
116	Thermax enters the green hydrogen market in partnership with Fortescue Future Industries	11-03-2023

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117	Empowered Group Formed for Green Hydrogen Mission	11-03-2023
118	Punjab to have green hydrogen policy soon'	20-03-2023
119	Amplus Solar to set up multiple distributed green hydrogen plants in Andhra Pradesh	22-03-2023
120	L&T signs agreement with McPhy Energy for electrolyser manufacturing	24-03-2023
121	HP signs MoU for green hydrogen project	29-03-2023
122	India 's Clean Energy Shift Holds $25-b Biz Potential	29-03-2023
123	Regulatory frameworks will boost green hydrogen ecosystem	04-04-2023
124	Auction for green H2 incentives to kick off in Q1 with cap of Rs 50/kg	06-04-2023
125	Govt Proposes to Extend Waiver of ISTS Charges for Green H2 Projects	12-04-2023
126	BPCL to set up 240 MW renewable power facilities, to bid for industry tenders	21-04-2023
127	Tata Steel tests hydrogen in furnace to cut carbon output	26-04-2023
128	Brookfield to pump $1 billion into Avaada green hydrogen (gH2) venture	27-04-2023
129	Delhi: IGL joins green hydrogen bandwagon	07-05-2023
130	Energy PSUs eye 38,000 tonnes per annum green hydrogen capacity	09-05-2023
131	Energy PSUs Eye 38k tpa Green H2 Capacity	09-05-2023
132	Green hydrogen: Land policy framed in Gujarat	11-05-2023
133	Green Port policy launched to catalyze carbon reduction	11-05-2023
134	Seven realities to deal with for building a carbon-free world	14-05-2023
135	G20 Energy Panel Focuses on Green Hydrogen Standards'	16-05-2023
136	HP to get new Green Hydrogen Policy: CM	22-05-2023
137	Green hydrogen park on 26k acres mooted in Kandla	24-05-2023
138	India Moots Global Norms for Green H2	24-05-2023
139	Punjab to soon come up with green hydrogen policy	25-05-2023
140	Adani Green to seek board nod to raise up to $1 billion	25-05-2023
141	Govt Waives Interstate Transmission Charges on Offshore Wind Power Units	30-05-2023
142	Climate-tech startup Newtrace raises $5.6 million in funding from Sequoia, others	01-06-2023

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144	Epicentre for Green H2 Development	15-03-2023
145	India well placed to emerge as green hydrogen hub: Hardeep Puri	16-06-2023
146	Green open access: As it opens up sea of opportunities, one needs to tackle threats	19-06-2023
147	India 's Energy Transition to be Fastest in the World: Minister	21-06-2023
148	India , US likely to join forces on green H2, carbon capture and battery energy storage	22-06-2023
149	ACME Solar in Talks to Raise Debt of ?4,000 cr	23-06-2023
150	US President Biden and PM Modi's joint press conference: Full text	24-06-2023
151	Incentives Worth ?13K Cr on Offer in 1st Tranche of Green H2 Bidding	29-06-2023
152	Centre mulls floating LNG storages at major ports	01-07-2023
153	Torrent forays into green hydrogen with Gorakhpur pilot project	04-07-2023
154	Linde to invest $1 B in India over 3-5 yrs	04-07-2023
155	Bids Invited to Set Up Green H 2 Production Units	11-07-2023
156	IIT-I develops process to produce green hydrogen gas from PET waste in water	15-07-2023
157	Push to Guj's green hydrogen projects	17-07-2023
158	G20 Panel for Low-cost Funds to Aid Energy Transition Tech	21-07-2023
159	Clean hydrogen, Russia - Ukraine war major hurdles in G20 energy transition consensus	23-07-2023
160	Adani New Industries raises $394 million from Barclays and Deutsche Bank	28-07-2023
161	FM: PLI Scheme Likely for Chemicals & Petrochem	28-07-2023
162	Goa working on green hydrogen energy plant: CM	29-07-2023
163	India , Saudi Arabia aim for cooperation in green hydrogen	04-08-2023
164	Centre may allow overseas trading of carbon credits with other countries	05-08-2023
165	RIL Aims to Provide Affordable Green H2	07-08-2023
166	RIL Aims to Provide Affordable Green H2 as Viable Alternative, says Ambani	07-08-2023
167	L&T & Partners to Invest $4 b in Green Hydrogen Projects	10-08-2023

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169	Govt Defines Norms for Green Hydrogen	20-08-2023
170	Amberpet STP to get city's 1st green H2 plant	22-08-2023
171	Hartek is betting big on floating solar and green hydrogen	23-08-2023
172	HSBC 's green hydrogen partnerships unveiled by FM	25-08-2023
173	L&T, IOCL & Renew form a joint venture for green hydrogen	27-08-2023
174	Ahead of AGM: Will Mukesh Ambani increase reliance on new energy business?	27-08-2023
175	Prepare effective policy to make UP biggest green hydrogen producer: CM Yogi Adityanath	01-09-2023
176	AP eyes $15 bn investment in green hydrogen sector	04-09-2023
177	Aim to Make India a Refuelling Hub for Green Ships: RK Singh	06-09-2023
178	With cheapest fuel, India aims to become global refueling hub for green ships; here's how	07-09-2023
179	Green hydrogen unit in Gopalpur	09-09-2023
180	India , Saudi Arabia sign pact on renewable energy	12-09-2023
181	India , Saudi Arabia look to marry power grids with undersea cable	12-09-2023
182	Green hydrogen research:UP to have two centres soon	13-09-2023
183	Adani , Kowa form JV to sell green hydrogen in Japan , Taiwan	15-09-2023
184	Adani Group Arm Teams up with Kowa to Sell Green Hydrogen	15-09-2023
185	IIT-Madras to work on R&D of 'Green Hydrogen'	17-09-2023
186	CM approves draft of Green Hydrogen Policy	18-09-2023
187	Bengal should have green hydrogen policy: Minister	19-09-2023
188	Green Hydrogen, A Gas?	22-09-2023
189	Delhi gets its first buses running on green hydrogen	26-09-2023
190	Govt identifies three ports to export green hydrogen, ammonia and methanol	02-10-2023
191	Can hydrogen propel the decarbonisation of India 's transport sector?	05-10-2023
192	Green hydrogen policy targets 2 million tonnes per year by 2030	07-10-2023
193	Announcement Likely This Week	30-10-2023
194	NSI workshop to deliberate on 'fuel of future'	17-11-2023
195	Welspun Planning to Re-enter Green Energy Sector, says Chairman	18-11-2023
196	Indo- German bilateral workshop at IIT-Bhilai	24-11-2023

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198	Adani Total Gas launches GH2 blending pilot at Ahmedabad	28-11-2023
199	Adani launches green hydrogen blending project in Ahmedabad	29-11-2023
200	Gujarat focuses on green hydrogen ahead of Vibrant Gujarat Global Summit 2024	01-12-2023
201	NKDA in talks with institutes to introduce hydrogen buses	04-12-2023
202	Green hydrogen policy to help tackle agri residue, says Punjab minister	08-12-2023
203	PLI schemes have started to yield desired outcomes	10-12-2023
204	India - Egypt strategic partnership have elevated to a new level: Hossam Heiba, CEO, GAFI	14-12-2023
205	Green H2 production: RIL Unit, BPCL & 12 others submit bids	16-12-2023
206	CM: Consult stakeholders before finalizing GH policy	27-12-2023
207	Torrent Power plans to raise up to Rs 650 crore via NCDs	03-01-2024
208	Green H2 tender: Two companies seek zero incentives	04-01-2024
209	Erisha E-Mobility to invest Rs 6,900 crore for green hydrogen, mega EV park	05-01-2024
210	Seminars on green hydrogen, RE on Jan 12	06-01-2024
211	Modi Convenes with Leading CEOs, Deliberates on Made-in-India Vehicles and Green Hydrogen	09-01-2024
212	GIM about relationships, govt focused on follow-up	15-01-2024
213	GIFT City, IGX and GSPC collaborate for global hydrogen trading	17-01-2024
214	SOUTHERN SUCCESS	22-01-2024
215	PLIs Help Reliance Inch Closer to $1-1.5/kg Green Hydrogen Target	23-01-2024
216	ACME in pact to supply 400,000 tonnes/year green ammonia to Japan ’s IHI Corp	24-01-2024
217	Economy picks up renewed energy	24-01-2024
218	CPCL & IIT Madras tie up for green hydrogen production	25-01-2024
219	ReNew mulls Rs 26,400 crore green hydrogen project in Kerala : Report	29-01-2024
220	Fuel price cut reports speculative: BPCL	30-01-2024
221	Budget 2024: India needs investment appetite for green energy	31-01-2024
222	Gujarat can lead world in green hydrogen	02-02-2024
223	Centre to support retrofitting ships to run on Green Hydrogen	03-02-2024
224	Won’t have any power cuts this summer, says George	06-02-2024

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225	Scaling up demand must for green H2 success: IEA	09-02-2024
226	Karnataka wipes slate clean, drafts new policy for electric vehicle sector	10-02-2024
227	Hero Future Energies eyeing green hydrogen opportunities	12-02-2024
228	ACME looks to sell 35% stake to raise Rs 3,000 crore	15-02-2024
229	Infrastructure gets a green push	17-02-2024
230	IOC Scraps Green H? Plant Tender as Bidders Cry Foul	27-02-2024
231	India can be a key player in Hydrogen sector that could become half a trillion industry by 2050	29-02-2024
232	French cos eye investments in tech, green hydrogen	01-03-2024
233	Hry frames green hydrogen policy, eyes 250ktpa in 6 yrs	01-03-2024
234	EAM Jaishankar in Seoul , explores semiconductors, green hydrogen, tech tie-up	07-03-2024
235	Greenzo Energy unveils indigenous alkaline electrolyser for green hydrogen production	08-03-2024
236	19 green hydrogen projects in pipeline	09-03-2024
237	Govt seeks bids for electrolyser manufacturing under SIGHT	17-03-2024
238	Govt greenlights 63k ha for green hydrogen production	03-04-2024
239	Have RE Without the Havoc	03-04-2024
240	GH2, Green Ammonia to Drive $125 B Investments in India by 2030: Avendus	04-04-2024
241	Action Plan for Green Shipping	10-04-2024
242	Asia’s largest economies set to drive $180 billion green hydrogen market by 2050, report finds	12-04-2024
243	BJP Sankalp Patra: How BJP wants to make India a global hub for renewable energy	14-04-2024
244	IREDA opens new office at GIFT City	19-04-2024
245	Greenko ZeroC to Supply 500,000 t Green Ammonia to Norway’s Yara	14-05-2024
246	GAIL starts India ’s largest green hydrogen plant	27-05-2024
247	HOW GREEN IS TN’S HYDROGEN?	27-05-2024
248	CPT workshop discusses future of hydrogen fuel	10-06-2024
249	From Chimneys to Skies, NTPC Explores Sustainable Aviation Fuel	10-06-2024
250	Sipcot floats tender for 60MLD desalination plant in Tuticorin	11-06-2024
251	Greenko in talks with REC to raise up to Rs 2,400 crore	27-06-2024

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253	World Bank lends $1.5 billion push to power green hydrogen market	29-06-2024
254	AM Green, SJVN arm ink MoU for supply and sourcing of green energy	02-07-2024
255	Green H2 Mission: MNRE Issues Incentive Norms	06-07-2024
256	Budget 2024 may propel a key element of the Modi govt's Panchamrit goals	10-07-2024
257	Adani , Avaada, BHEL among 23 Cos Eye Electrolyser Sops	12-07-2024
258	Adani , BHEL , Avaada Among 23 Cos to Set SIGHT on Electrolyser Sops	12-07-2024
259	Only 2 Cos Bid for Indian Oil's Green Hydrogen Project	16-07-2024
260	Indian Oil Corp receives two bids for green hydrogen plant amid scrutiny and industry concerns	16-07-2024
261	Ohmium Plans to Double B'luru Electrolyser Capacity	20-07-2024
262	Budget 2024: The approach needed around infrastructure, health, and renewable energy	22-07-2024
263	Thermax to develop tech for its green hydrogen biz	02-08-2024
264	Indian Oil Corporation cancels green H2 tender yet again	06-08-2024
265	Chamba to get HP 's first-ever green hydrogen mobility stn	06-08-2024
266	India must spend in green hydrogen R&D, infrastructure: Ganapati Myneni	13-08-2024
267	Bucket-filling Approach	17-08-2024
268	Green Ammonia Scheme: Bidders invited to visit procurers' fertiliser plants	21-08-2024
269	Egypt working towards increasing Indian investments through multiple incentives	21-08-2024
270	CM Stalin lays foundation for India 's 1st green hydrogen plant	22-08-2024
271	BPCL to invest Rs 75,000 crore in expanding refining capacity	30-08-2024
272	Bharat Petroleum to invest Rs 75,000 crore in expanding refining capacity	31-08-2024
273	US 's Ohmium to set up green hydrogen unit with 400cr investment	02-09-2024
274	India could be a green energy powerhouse	04-09-2024
275	India to Launch GH2 Certification Scheme	09-09-2024
276	Govt Releases Plan for Green Hydrogen Certification	09-09-2024

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277	India aims to become global hub for green hydrogen, says PM Modi	11-09-2024
278	Aim to make India green hydrogen hub	12-09-2024
279	Production of green H2 to begin by 2027	17-09-2024
280	GUJ AIMS TO ADD 128GW OF RE CAPACITY BY 2030	17-09-2024
281	India Scores on Subsidies for Green H2: ReNew CEO	18-09-2024
282	Centre is helping states meet green energy goals, says Union Renewable Energy Minister Joshi	18-09-2024
283	Cabinet approves 2 green hydro units in MMR	24-09-2024
284	Indian Oil flags off bids for third time for green hydrogen plant at Panipat	29-09-2024
285	Greenzo to Supply Electrolyzers to RBM Infracon	05-10-2024
286	AM Green, Gail tie up for 2.5GW hybrid renewable energy projects	05-10-2024
287	PPP to boost India's green hydrogen plan	13-10-2024
288	How modern technologies shaping India's journey towards clean energy transition	17-10-2024
289	Centre Gives Nod to 3 Green Hydrogen Pilot Projects for Steel Cos	19-10-2024
290	Green Hydrogen blending will have negligible impact on consumer fuel prices: Report	22-10-2024
291	AM Green, John Cockerill partner for green ammonia project in AP	31-10-2024
292	AM Green Places India's Largest Electrolyzer Order for AP Plant	01-11-2024
293	CM for green hydrogen rail on Kalka-Shimla line	05-11-2024
294	NTPC to Set up Seawater-to-Green Hydrogen Plant in Andhra Pradesh	19-11-2024
295	PM Modi to lay stone for green hydrogen hub in Vizag on Friday	25-11-2024
296	3L skilled workers needed to meet green hydrogen target	04-12-2024
297	Am Green signs PPA with Gentari for 650mw clean energy to power green ammonia plant	10-12-2024
298	Among 14 Bidders for Green H? Tender	11-12-2024
299	Rel Green, ReNew Among 14 Bidders for Green H? Tender	11-12-2024
300	Ammonia Supply in SIGHT of NTPC Green Energy	20-12-2024
301	PDEU team produces green hydrogen in Navsari's Unai	30-12-2024
302	IOC's green H2 tender expects better response	07-01-2025

Continued on next page

Table E.1 Continued from previous page

Sr No	Newspaper Title	Date
303	Bengal govt woos investors for green hydrogen units	08-01-2025
304	Aiming to produce 5 million tons of Green Hydrogen by 2030: PM Modi	09-01-2025
305	PM launches over Rs 2lakh-cr projects for Andhra Pradesh	09-01-2025
306	Target to increase biofuel blending to 20% by Oct: Puri	12-01-2025
307	Waaree, L&T, Reliance among 10 cos to win incentives for tranche-II of green H2 tender	20-01-2025
308	L&T, Waaree and Reliance among 10 Winners of Green Hydrogen Mfg Sops	21-01-2025
309	A clean, green republic in the making	26-01-2025
310	How Budget 2025 can green India's energy policy and help it achieve net-zero goals	29-01-2025
311	VOC Port's outer harbour project will drive growth in the region	03-02-2025
312	HP launches north India's 1st green hydrogen plant	06-02-2025
313	Gujarat ready to be green hydrogen hub: Governor	20-02-2025
314	India eyes 20% ethanol blending in petrol, says minister Hardeep Singh Puri	27-02-2025
315	Biomass Gasification Essential for Green Hydrogen, Says Dr Sheth	01-03-2025
316	The role of hydrogen fuel cells in the next wave of clean transportation	13-01-2025

F

Appendix

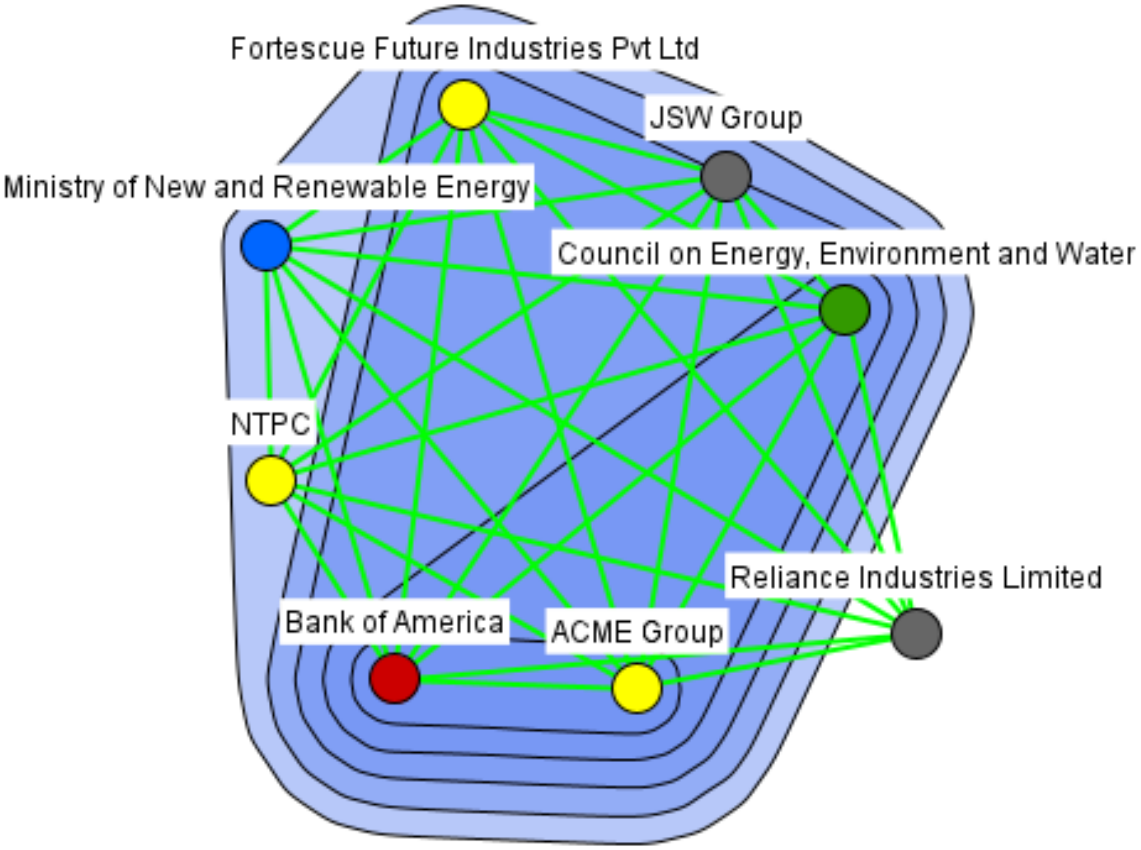

Figure F.1: One-mode Network: National Hydrogen Mission Phase

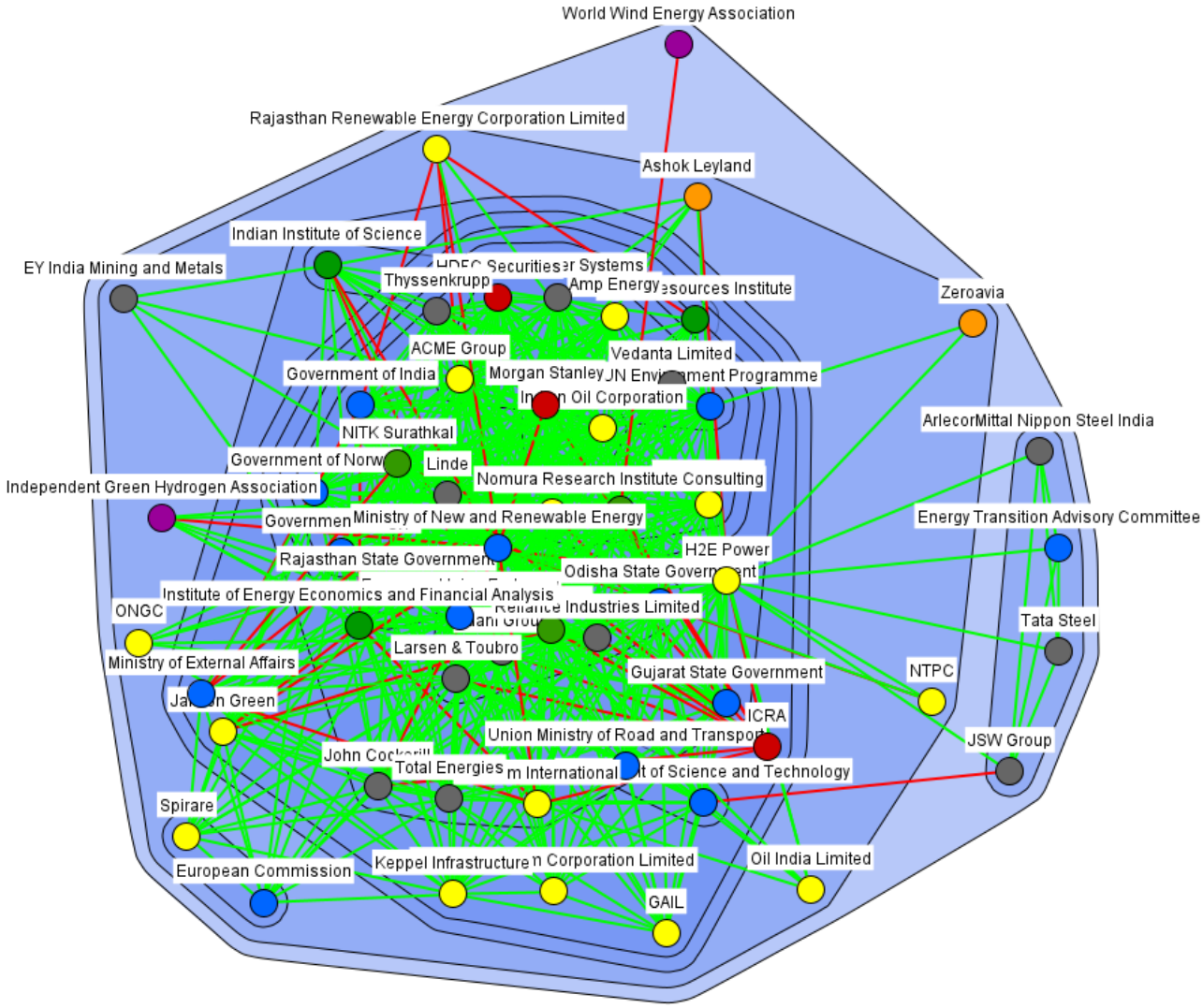

Figure F.2: One-mode Network: National Green Hydrogen Mission Phase

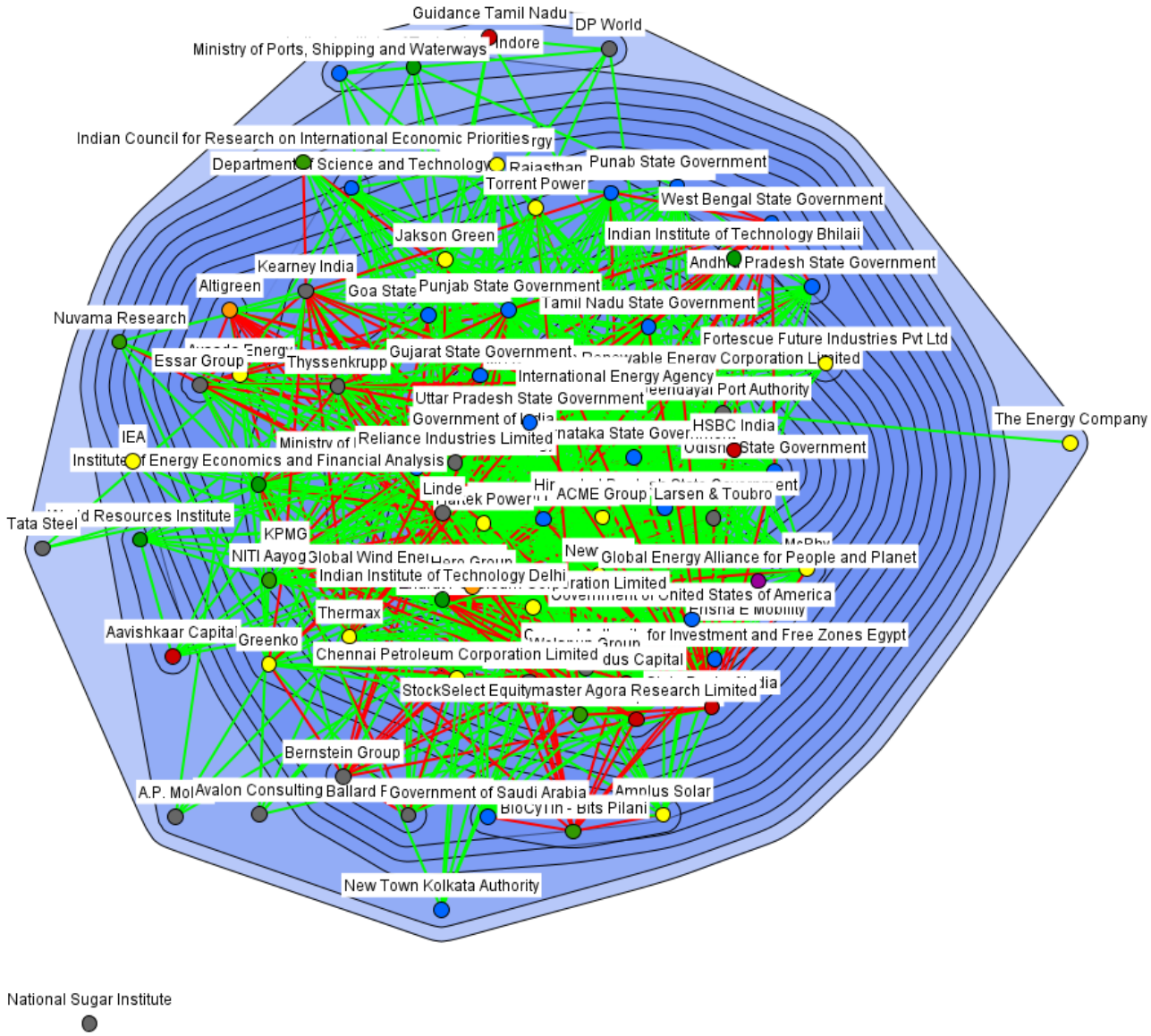

Figure F.3: One-mode Network: Policy Consolidation Phase

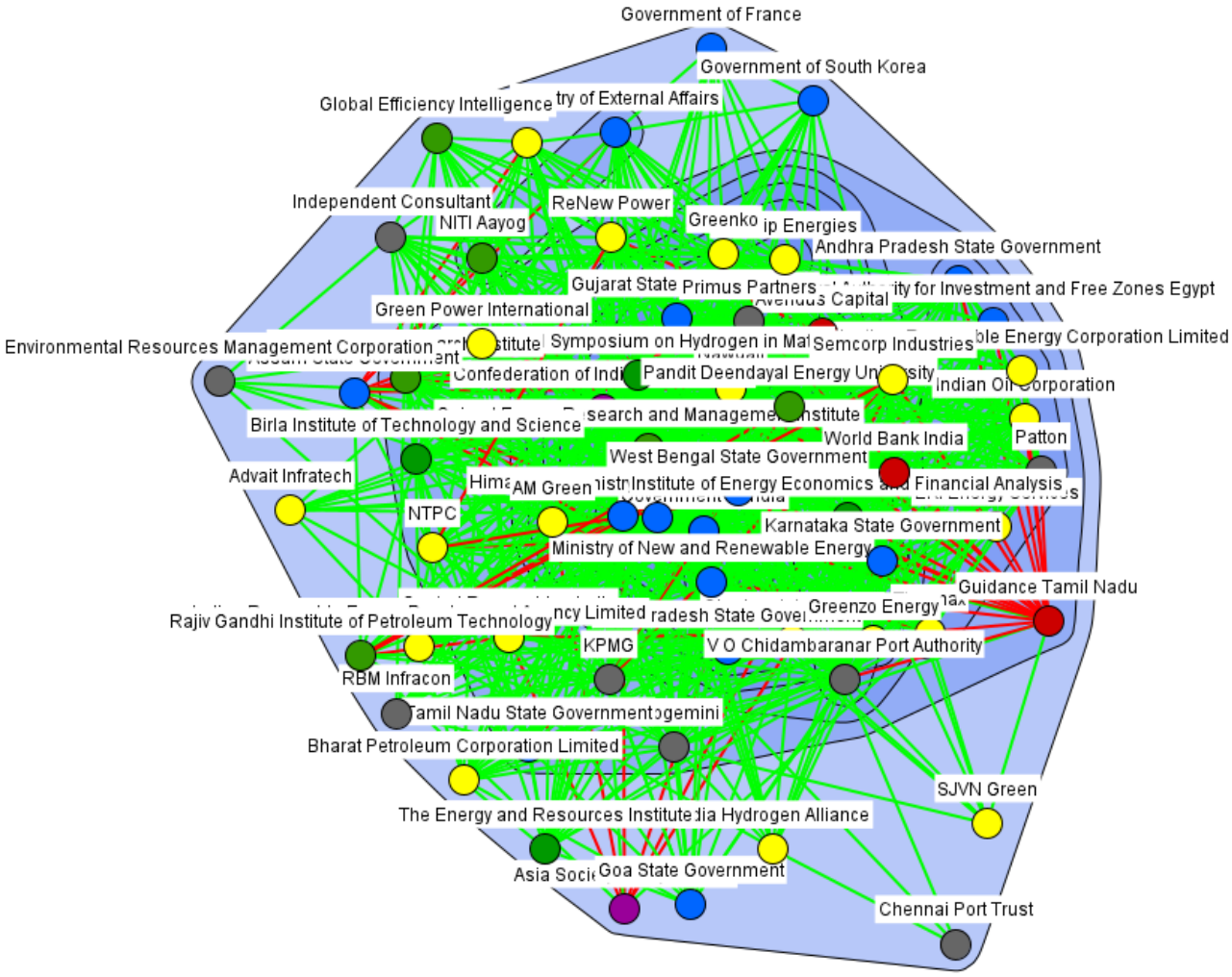

Figure F.4: One-mode Network: Budget Boost Phase

G

Appendix

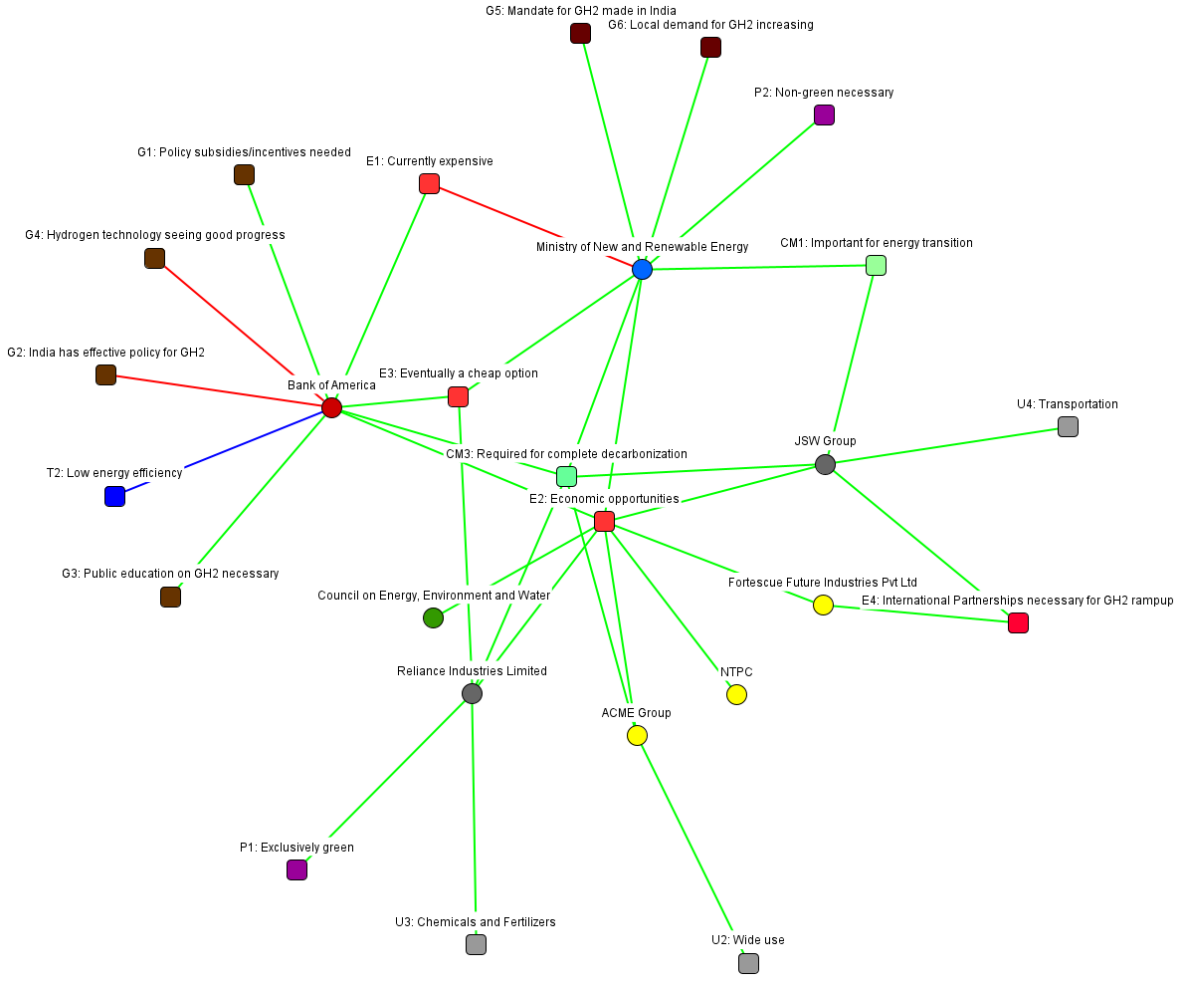

Figure G.1: Two-mode Network: National Hydrogen Mission Phase

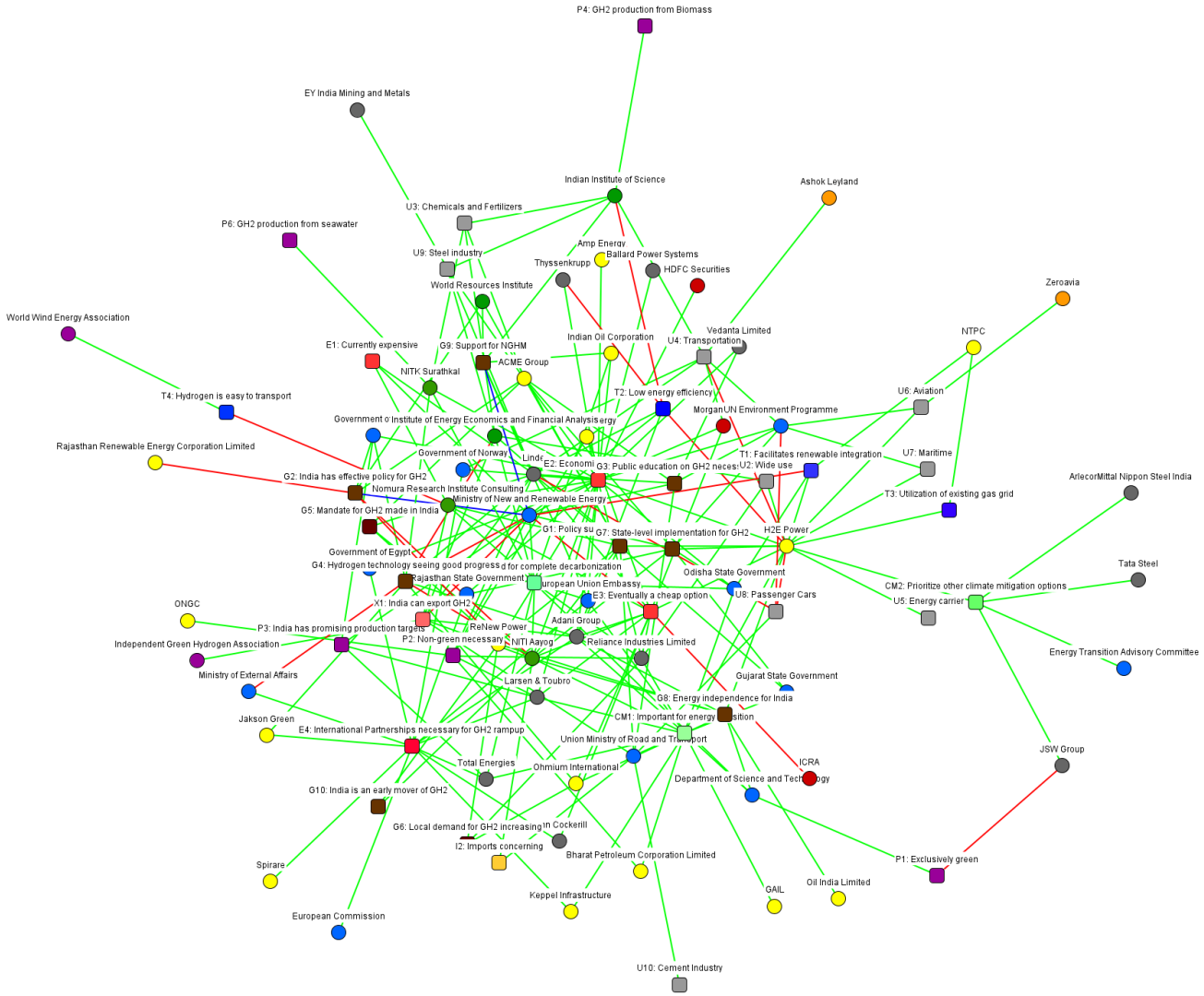

Figure G.2: Two-mode Network: National Green Hydrogen Mission Phase

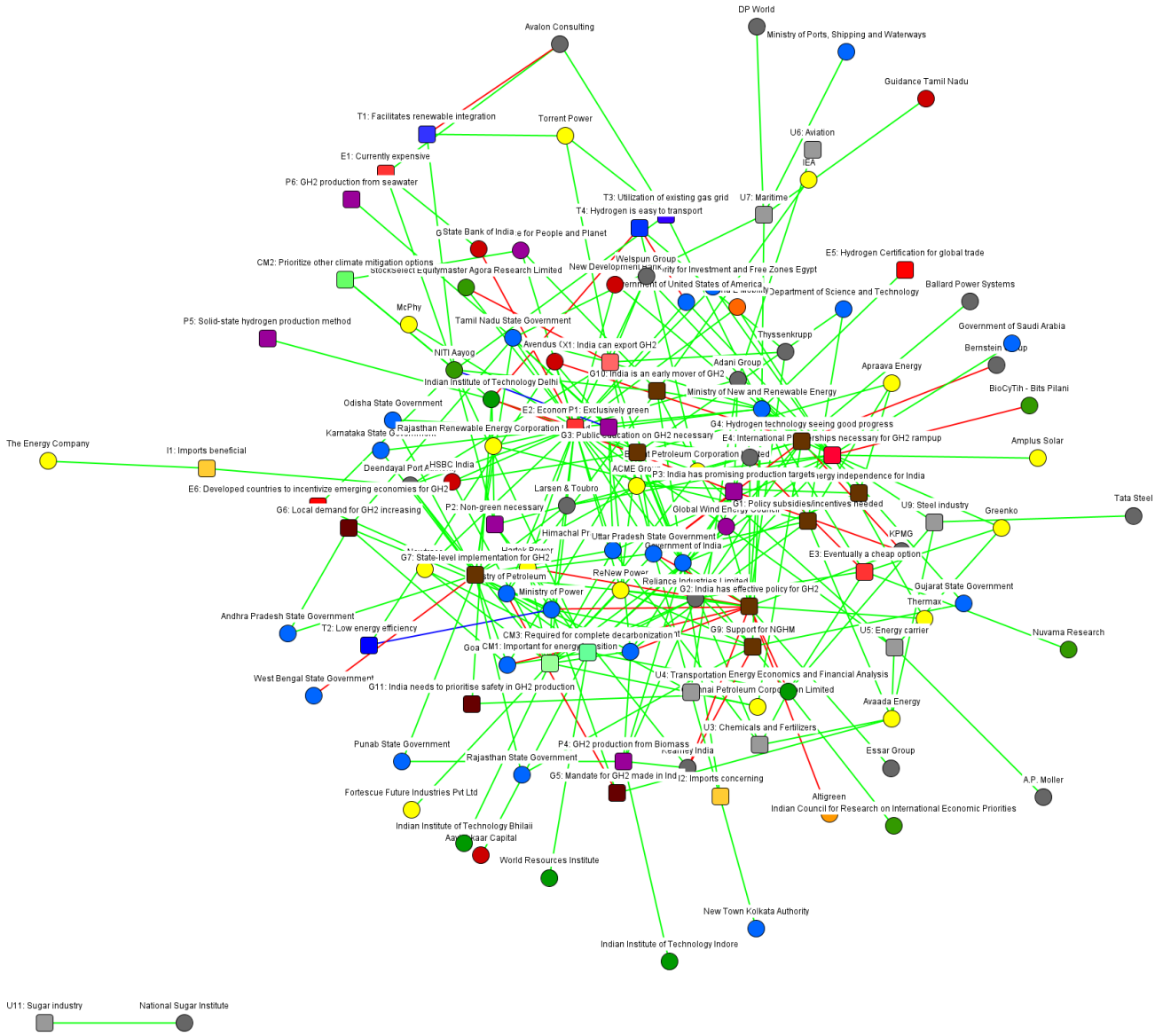

Figure G.3: Two-mode Network: National Green Hydrogen Mission Progress Phase 1

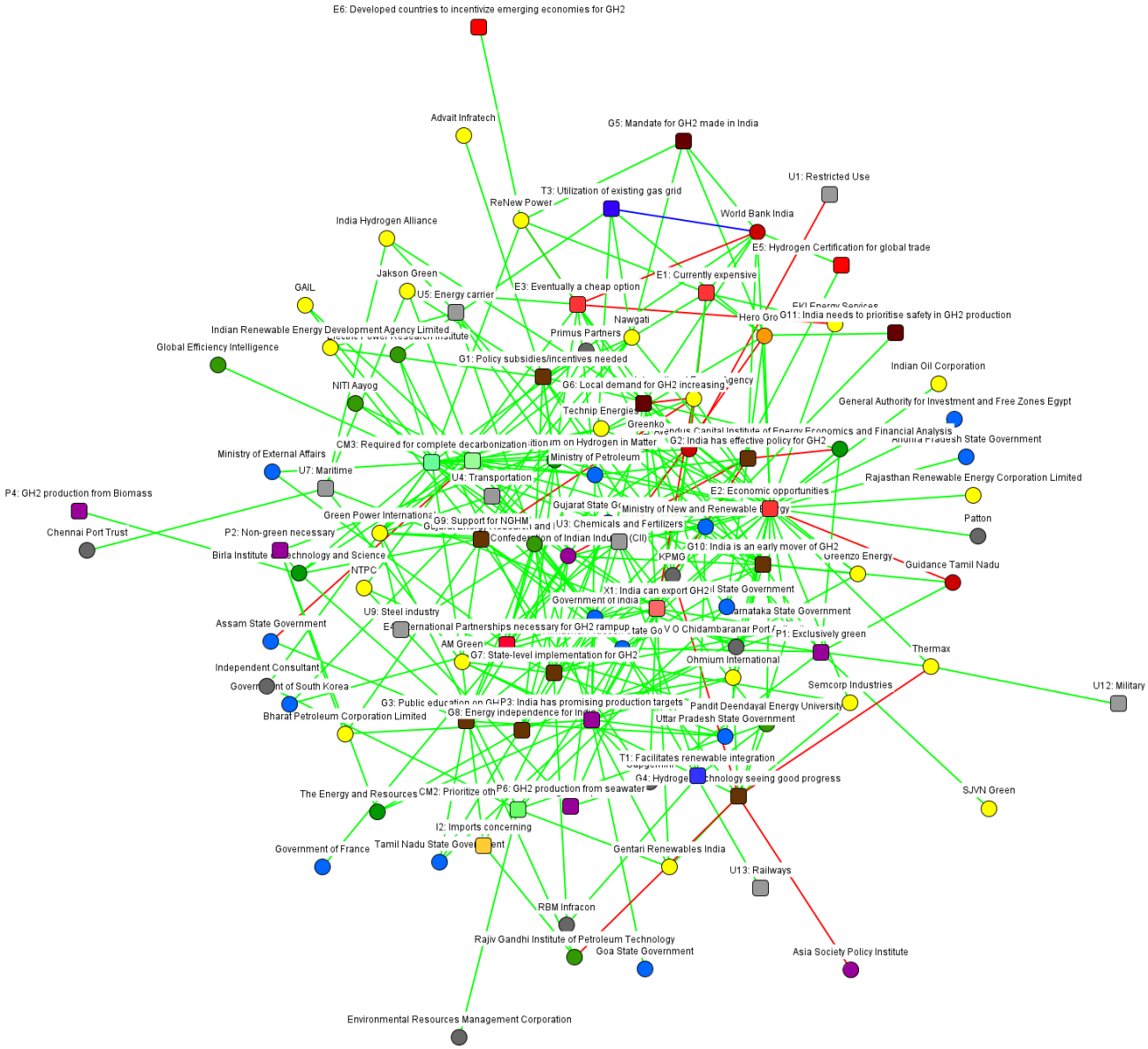

Figure G.4: Two-mode Network: National Green Hydrogen Mission Progress Phase 2