From shortage to surplus

A study of the political economy of Nepalese electricity development

Elin Grytten Sandnes

Master Thesis in Human Geography

Department for Sociology and Human Geography

Faculty of Social Sciences

UNIVERSITY OF OSLO

Spring 2022

Word count: 48064

From shortage to surplus

A study of the political economy of Nepalese electricity development

Elin Grytten Sandnes

2022

From shortage to surplus: A study of the political economy of Nepalese energy development

Elin Grytten Sandnes

http://www.duo.uio.no

Summary

After struggling with severe electricity deficiency for many years, Nepal has finally come one step closer to its vision of becoming a "hydropower nation", by coming into electricity surplus in the wet season. However, they still have far to go to reach their ambitious electricity strategy. This master thesis addresses how the electricity development of Nepal is shaped by its global context. It investigates this by answering the research question: *Which political and economic factors influence the progress of Nepal's electricity development, and how?* The thesis is a qualitative case study and is based on interviews of people with broad and deep knowledge and experience of the Nepalese energy sector. Thematic analysis is used to identify themes considered important by informants. In the analysis a mapping of the energy system and its components is conducted to form a basis for explanation. Then different political and economic factors, how they relate to the state level, and how they lead to progress or delays in four different hydropower projects are examined. While previous research has done system mappings or examined the political economy of Nepal, no research has combined the two approaches.

Theories of how global processes and mechanisms influence energy systems in countries with limited financial resources point to influence from three areas or kinds of factors. Those are: international and multinational sources of financing, geopolitics, and the climate and environmental regime. The most important finding in this thesis is that geopolitical factors lead to the most delays in the current shift from electricity deficiency to surplus. This is mainly due to its implications for further investments in energy generation projects, as it blocks Nepal's strategy of exporting power surplus. This factor's influence is increased by Nepal's challenges with increasing electricity consumption. This research also shows that access to sources of funding has been highly important. A consequence has been that actors with access to the needed capital could gain more influence over the progress in the sector and thus limit Nepal's policy space. Today, however, Nepal's policy space seems to be more limited by their relationship to India, than by the influence of powerful economic actors. Many other factors have also limited progress, such as increasing risk of environmental and natural disasters on hydropower projects. Several issues on the state and local level, such as lack of good planning, political conflicts, corruption and local opposition have also caused delays for hydropower projects. Together, they may explain the slow progress with electricity development in Nepal, and the difficulties with moving from electricity shortage to surplus.

Acknowledgements

There are many people who deserves a heartfelt thank you, for in some way or other helping me write and finish this thesis.

First, I am very grateful to my supervisor Kirsten Ulsrud. Thank you for helping me turn my ideas into a full-fledged thesis. Your contribution has been invaluable.

Thank you to the researchers who discussed with me in the early phases of this project: Co-supervisor Andrea Nightingale, Synne Movik and Mikkel Vindegg.

I am grateful to the Fridtjof Nansen Institute for giving me a master thesis scholarship and a place to work at beautiful Polhøgda, and to everyone who works there for providing their expertise. A big thank you also goes to Tor Håkon Jackson Inderberg for the feedback and advise.

To spend a whole year on one's own research project also requires the moral support of family and loved ones. I would therefore like to thank my mom and dad for all the ways you back me up, every single day. To my dear roommates Julie and Tina, thank you for keeping up with me. Thank you to Sina, for all the support. I am also grateful for my fellow students and friends at UiO, thank you for making student life at Blindern meaningful and fun. And to Jasper, thank you for the read-through. But more importantly, thank you for helping me maintain perspective on the things that are really important.

Lastly, I would like to thank all who participated in the project, both the people who shared their knowledge and perspectives with me as informants, and those who guided me to relevant contacts.

Elin Grytten Sandnes, Oslo, May 2022.

Abbreviations

ADB – Asian Development Bank

AEPC – Alternative Energy Promotion Centre

COP - Conference of the Parties

DOED - Department of Electricity Development

GoN – The Government of Nepal

IBN – Investment Board of Nepal

IFIs – International Finance Institutions

IPO – Initial Public Offering

IPPAN – Independent Power Producers Association Nepal

IPPs – Independent power producers

MoU – Memorandum of Understanding

MW – Megawatt

NDC – Nationally Determined Contribution

NEA – Nepal Electricity Authority

NORAD – Norwegian Agency for Development Cooperation

PPA – Power Purchase Agreement

USAID – United States Agency for International Development

UTHL – Upper Tamakoshi Hydropower Ltd.

WB – World Bank

Content

1 Introduction

In the 1950s a Swiss geographer visited Nepal and named the rich water resources in the country as “white gold”. This was the start of a long-lasting powerful idea about the export-oriented and revenue-generating potential of the hydropower resources to make the country prosperous. Over the following decades, this imaginary provided a sense of Nepal as a hydropower nation, and it also provided a sense of national unity, according to Movik & Allouche (2020, p. 4). A study done in 1967 estimated the theoretical hydropower potential in the country to be 83,000 MW installed capacity (Sharma & Awal, 2013). Since then, as experienced by an informant for this thesis “from childhood, every Nepali hears ‘we have big hydro potential of 83,000 MW’”. This precedence created a mindset that if Nepal can develop its hydropower resources, it will become a very rich country (Movik & Allouche, 2020).

Since the reinstatement of multi-party democracy in Nepal in 1991, a political consensus has formed around promoting a hydropower and export-led energy development, with the consecutive elected governments setting ambitious targets for electricity generation. As Nepal at the time was highly aid dependent, a large issue was where the funding should come from. In parallel, a Maoist insurgency or civil war arose, and further hydropower construction was effectively disrupted until the conflict ended in 2006, and a new constitution formed in 2008 (Hatlebakk, 2017; Movik & Allouche, 2020; Roy, 2017; Wahid et al., 2016). This manifested itself in stately planned daily power outages, called load shedding, lasting up to 18 hours a day between 2008 to 2017. The severe electricity shortage has made Nepal dependent on importing electricity as well as petroleum and gas from India. This became a problem when a trade blockade formed along the border between Nepal and India right after devastating earthquakes in 2015. The blockade effectively cut off all imports to Nepal and deepened their energy crisis (Roy, 2017; Vindegg, 2020).

Throughout these events the elected governments have kept the ambitious strategies, and since the first private and foreign funded plant came online in early 2000s the sector has seen much activity, with major foreign investments and great influence from international financing and aid. With the long-awaited Upper Tamakoshi plant coming online in 2021, after several years of delays, 400 MW was added to the Nepalese grid. This finally brought

some power surplus. This may give Nepal the possibility of exporting electricity to neighbour countries in the wet seasons. However, with delays or complete halts in projects being a common problem, Nepal still has far to go in their slow progress towards reaching their strategies and visions (Dixit & Gyawali, 2010; Lord & Rest, 2021; Movik & Allouche, 2020; Prasain & Shrestha, 2021).

1.1 Aim of the research

The idea for this master thesis started with the question of why Nepal, despite a high hydropower potential and a policy focus on hydropower development since the end of World War 2, not until the autumn 2021 achieved an electricity surplus. This question or interest comes from a bachelor-thesis fieldwork to Nepal in 2019, where I studied climate adaptation in connection with a large-scale hydropower project, the Upper Tamakoshi. My motivation for studying the efforts to produce more electricity is that energy is seen as important for both livelihoods and national development, especially in the context of global climate change (Blondeel et al., 2021; Newell, 2021). This makes me interested in understanding how countries dependant on aid or foreign funding for energy development may electrify through renewable energy sources. Nepal's energy development is focused on renewable energy, and if they manage to use their natural resources better, they may see benefits such as ending the current coal power-based electricity imports from India. I therefore find it important to understand more about what is shaping their efforts around energy. The goal of this thesis is thus to broaden the knowledge on how electricity development in states with limited funds are influenced by global processes, and more specifically to broaden the understanding of what shapes Nepal's work on expanding the power supply.

Previous research on this field has looked into the impacts of hydropower projects in Nepal at national level such as Dixit and Gyawali (2010), or resistance at local level, such as Dhunga and Maskey (2019) and Sikor et al. (2019). Some research looks at how energy development in Nepal is influenced by foreign aid, for example Movik and Allouche (2020), Sharma and Bhattarai (2019) and Sovacool, Bambawale et al. (2011). Both Roy (2017) and Hatlebakk (2017) are focused on Nepal's political economy overall, but also include energy in their analyses. Others study the connection between energy development in Nepal and India, such as Pradhan (2009), and Vindegg (2020). A study by Ogino et al. (2019) analyses

barriers to hydropower development and trade by taking internal factors into account, while Sovacool, Dhakal et al. (2011) take a socio-technical perspective on factors impeding small- and medium-sized hydropower plants in Nepal. Singh et al. (2020) and Butchers et al. (2021) studied different scalings of hydropower. Many articles on the topic of energy in developing countries take an "energy poverty" perspective, like Heringtona and Malakar (2016), or like Nepal (2012), Yadoo and Cruickshank (2012), Gurung et al. (2012) who look at how renewables can be used for rural development through decentralised systems. Several works of research look at how climate change influences hydropower development, such as Wahid et al. (2016), Molden et al. (2014) and Bhatt (2017). What has not been researched sufficiently is why the progress of electricity development has gone so slowly, and the importance of political and economic factors at national and international levels on electricity generation. This thesis will address that topic.

1.2 Research question

The research was boiled down to the research question: *Which political and economic factors influence the progress of Nepal' s electricity development, and how?*

By progress I here mean both the actual construction of projects and implementing and achieving strategy targets, which goes beyond just achieving electricity surplus. Wider benefits such as seeing profitability from power sale, increasing the domestic and foreign electricity market, and in general an energy development that benefits the population might also be examples of progress. The emphasis will be placed on factors that emerged as important during the early phases of data collection: 1) financing 2) geopolitics 3) climate change and environmental agreements 4) the role of state characteristics. Financing was included due to previous knowledge of development projects in developing countries, as well as early readings on the Nepalese sector. The second factor, geopolitics, comes from a combination of theory work and early readings on energy in Nepal. The third factor comes from theory work. And finally, one last factor, being characteristics of the state, was included after data collection. I will be tracing the strategies and efforts to implement the strategies from the development of the first privately funded hydropower plant in the 1990s, however, the focus will be placed on present-day challenges and strategies.

1.3 Delimitations

Two conceptualisations of scale are relevant for this thesis, and to limit its scope. Firstly, scale may refer to political levels (Jordhus-Lier & Stokke, 2017). In this thesis, I have chosen to focus on strategy and implementation efforts coming from mainly the national or state level, because this is usually where decision-making around energy is done. For example, Cherp et al. (2018) choose a state focus to study energy system's change, because the national scale, despite its large complexity, relates to well-defined laws and regulations, national economies, infrastructure, and natural resources. The nation-state also has the clearest mandate to govern the energy system (Cherp et al., 2018). Why decision-making is done at this level might be explained by Bridge et al. (2018), arguing that energy infrastructures are often objects of desire for national development and societal progress, and they represent an opportunity for being sustainable and sovereign. Political levels are socially constructed and influenced by their contexts, and must therefore not be seen as separate and static, but as relational and a product of actors and strategies shaping multiple levels simultaneously (Herod, 2011 in Jordhus-Lier & Stokke, 2017)). With this in mind, this thesis will study how the state-level development of the sector interacts with and is shaped by events and processes mainly at the *international* level.

The second conceptualisation of scale that I find useful here is as distribution or size (Jordhus-Lier & Stokke, 2017). This is relevant in relation to energy infrastructure and scale of energy production. Scale is especially relevant for renewable energy technologies because they can be deployed across a wide range of sizes (Bridge et al., 2018). Though other scales and types of energy is relevant for Nepal, this thesis is delimited to focus on electricity projects at the national level, being mainly hydropower projects of medium- to large scale connected to the national grid, because this is the focus of the Nepalese electricity strategy.

I use four hydropower projects as specific examples of energy development in Nepal. They were selected because they are some of the most discussed and important today. . 1) Upper Tamakoshi (456 MW). This is the 'national pride project' of the country and first to be domestically financed. It was connected in 2021, after several years of delays. 2) Arun III (900 MW). This is being constructed by Indian developers and is an export-oriented project with direct transmission to India. The project was initially supposed to be financed by amongst other the World Bank. 3) Tamakoshi III (200 MW). This is currently in planning by Nepalese and Chinese developers. The project was initially meant to have an installed capacity of 650 MW and be developed by Statkraft. Lastly, 4) Khimti 1 (60 MW) was

included after data collection. This project was the first privately financed hydropower project of scale in Nepal, and was built by Norwegian developers.

1.4 Structure

Chapter 2 presents the theoretical framework, which combines insights from socio-technical system theories with political economy literature. In chapter 3, the methodology of the thesis is presented. This includes how data was collected, relevant reflections about the data and ethics, as well as a presentation of the analytical method of the thesis. In chapter 4, I present and analyse the empirical findings from data collection, first by mapping the Nepalese energy system as a socio-technical system, and thereafter by analysing how the different factors identified shape electricity strategy implementation. The examples of hydropower projects mentioned above will be drawn in where relevant. In chapter 5, I will discuss 3 questions from the empirical analysis in relation to the theoretical framework. In chapter 6, I will provide an answer to the research question, policy recommendations, discuss the transferability of this case, reflect on the theories used, and look at implications for future research.

2 Theoretical framework

In order to understand political and economic factors that influence the electricity development process in Nepal, I combine socio-technical systems theory with a political economy approach. I also bring in theories on spatial and scalar aspects of energy systems. An energy sector, or specific parts of an energy sector, can be seen as a socio-technical system, of actors, institutions, technologies and other kinds of elements, as further explained below. This chapter presents these theories and concepts and shows how they have been used to analyse the politics of energy. I conclude the chapter with an overview of how I will combine the theories in a framework of analysis.

2.1 Socio-technical energy systems

Socio-technical systems theory show that society and technology co-evolve (Cherp et al., 2018). An energy system such as the Nepalese consists not only of the physical infrastructure, but also of institutions, technology, laws, and rules. Thus, it is both material and social.

Energy infrastructure and supply are commonly understood as socio-technical systems. Socio-technical systems have been defined as linkages between elements that are important to fulfil societal functions and systems of provision, such as energy (Geels, 2004). Important elements of any socio-technical system are the specific technologies to fulfil its functions, the actors implementing or contesting them, actor-network, social practices by the involved actors, narratives, and policy-environments. The actors may be producers, consumers, scientists, state institutions, businesses, or societal groups (Byrne et al., 2020; Lawhon & Murphy, 2011; Ulsrud, 2015).

The established socio-technical systems in energy, transport, and other societal functions are maintained by structures that form over the course of decades. These systems are rules, norms and conventions that guide the implementation of certain technologies and are often referred to as "socio-technical regimes" (Geels, 2011; Ulsrud, 2017). The rules may be shared beliefs, competences, routines, legally binding contracts, institutional arrangements, related to technological design, and so on. They can be specific or implicit and followed based on habit. The rules guide the system and its actors, so that the technological

development starts to follow specific trajectories. Established systems thus tend to become 'path-dependent' (Geels, 2011; Newell, 2021; Poel, 2000). The path-dependency comes from strong economic interests like maintaining economies of scale, from habits that become taken for granted, and from politics and power relations, such as lobbying (Geels, 2011; Ulsrud, 2017).

As hydropower in Nepal is the dominant mainstream technology in the electricity system, this part of the Nepalese energy sector can be seen as a "regime", which is maintained by strong actors and interests (Geels, 2011). However, a regime is not static, it is continuously being reconfigured by the shifting nature of such factors as consumer demand, production, availability of finance, opportunities for infrastructure and changing political priorities (Newell, 2021).

Path-dependent or stable systems are challenged by experimental and emergent systems where innovations are developed by actors who are on the fringe of the dominant socio-technical system. Such alternative systems develop within protected spaces or niches, formed by subsidies, project grants, or research and development activities. The protected niche makes it possible for the actors to deviate from the rules of the more established system. The actors in a niche have expectations about the possible future of the relevant technology, and may form social networks, user-producer relationships and supply-chains to support innovation. The so-called multi-level perspective is used to analyse transitions from established to novel socio-technical systems. A system becomes open to technological innovations and the emergence of a new system when there are tensions and fluctuations in the regime, coming from for example external pressure (Cherp et al., 2018; Geels, 2004; Geels & Schot, 2007). The development of solar power as an emergent technology in the Nepalese energy system can be seen as a niche compared to the main focus on hydropower technology. Though solar power and other renewables will be presented as part of the Nepalese energy system, it is not the main focus of this analysis.

Socio-technical systems such as energy systems are influenced by a range of contextual factors at different levels. These factors include political and economic trends in society, global developments such as climate change, the work of global institutions, as well as changing discourses and ideologies (Newell & Phillips, 2016). They are everything that forms an exogenous environment outside the system, and exert a more indirect influence or pressure on the system than the actors directly involved. The actors in turn cannot in the short run return this influence. Such societal changes usually happen at a slow pace, but may

at other times come as a rapid shock, for example, a war or a crash in the global oil price. The contextual developments may have either a stabilising effect on a socio-technical system or a disruptive effect that puts pressure on the system and pushes it to change (Geels & Schot, 2007). Within transition theories, such diverse contextual factors are often bundled together in the concept of "socio-technical landscape", and one could say that this thesis scrutinises the role of specific "landscape" factors in how the Nepalese energy sector develops. However, the political economy theory presented below is more important to understand these factors, including how donors and international financial institutions are shaping and incentivising specific energy policies in different countries.

A large amount of the literature on socio-technical systems concerns *transition* (Kuzemko et al., 2018; Newell, 2021). Newell (2021, p. 27) describes transitions "as radical shifts in the provision of services such as energy, transport, food and sanitation". It may also broadly be defined as "changes from one socio-technical regime to another" (Geels & Schot, 2007, p. 399). Van de Graaf & Sovacool (2020, p. 144) defines an energy transition as "change in the overall energy system, usually to a particular fuel source, technology, or prime mover […] but also to new markets, new energy services, and new regimes".

In one way, some of the ongoing, gradual changes in the Nepalese energy system could be classified as an emerging transition. For instance, small-scale solar power is growing. However, this is not crucial in my analysis. My reason for using socio-technical system theory is not to analyse a transition, but to better understand the existing system for electricity provision, which includes some small-scale technology. Consequently, I will not study this case as a transition (a radical shift in the state of a system), but as a socio-technical system that has been gradually evolving over a long time, and continues to change.

2.1.1 Critique of Socio-Technical Systems literature

Socio-technical literature has not focused much on politics earlier (Bridge & Gailing, 2020; Graaf & Sovacool, 2020), but this has changed in recent years. The literature is not attentive enough to questions of geopolitics, diplomacy, or on political factors that influences interstate economic relations and domestic energy policies (Newell, 2021; Power et al., 2016). Another point of critique relates to socio-technical system literature not being that useful or applicable to study energy changes in developing countries nuances (Ramos-Mejia et al., 2018). For example, Power et al. (2016) believes the scholarship has a "Eurocentric

orientation", meaning that the assumptions made about markets, state capacity, institutions and infrastructure systems does not hold in a developing country context. The last point of critique is that the literature does not adequately recognise the spatial and scalar dimensions of changes in energy systems (Bridge & Gailing, 2020).

Despite of the critique, the writers mentioned here still find it worthwhile to use socio-technical system literature to study energy systems, also in developing countries (Newell, 2021). Some have combined socio-technical system literature with Political Economy literature, in order to address the mentioned critiques.

2.2 The political economy of energy systems

Political economy is a broad field or perspective which is used to study the relationship between states and markets, political and economic institutions, organisations, policies and their outcomes (Graaf et al., 2016; Newell, 2021; Robinson, 2015). Though it is hard to find a coherent or unified definition of political economy, it is often defined broadly as studies of how governments or states interact with the private sector or international markets. Another common tenet is that political economy recognises that the pursuit of wealth and pursuit of power, in other words politics and economics, should not be seen as separate (Gilpin, 1987 in Graaf et al., 2016)). Consequently, it is the focus of the interplay between global political and economic processes and how they play out in different contexts that unite this perspective, while methods, theories, ontology and epistemology are more diverging (Ravenhill, 2010 in Graaf et al., 2016). "Global political economy" and "international political economy" are labels used by different authors about similar approaches, both emphasising global political and economic relations (Goldthaug et al., 2018; Hancock & Sovacool, 2018; Kuzemko, 2019; Newell, 2021; Newell & Phillips, 2016).

Several authors have taken a political economy perspective when studying energy systems (Bridge & Gailing, 2020; Graaf et al., 2016; Newell, 2021). For example, according to Graaf et al. (2016) and Newell (2021) political economy is useful in studies of energy, because it helps to understand the relationships between states and markets at various levels, such as the interrelationship between globalisation and national-level change, in relation to energy.

In his book titled Power Shift, Peter Newell (2021) gives some more specific examples of how political economy can contribute in studies of energy systems and how they change. Firstly, political economy can provide a wide perspective to account for global experiences

in geographical areas where state capacity, institutions, infrastructure or markets are weak. Secondly, political economy can provide insights on geopolitics and diplomacy, which are political factors influencing economic relations between states and domestic energy policy choices. Thirdly, political economy gives attention to how transnational actors shape energy systems, and what implications this has. For example, it considers the role of powerful transnational stakeholders such as multinational firms, donors, and banks, for how energy sectors develop.

Several scholars have also combined political economy literature with socio-technical systems and transitions literature to study energy systems (Bridge & Gailing, 2020; Kuzemko, 2019; Newell, 2021; Power et al., 2016). One benefit of adding political economy to socio-technical system literature might be to better engage with the political and social context that decision-makers are in when choosing energy pathways (Newell, 2021). Thereby, political economy can contribute to a better understanding of the socio-technical "landscape" mentioned above, and how it interacts with energy systems. Combining the two bodies of literature can help understanding "how, where and why transnational actors shape the regimes, landscapes and niches of energy systems and with what implications" (Newell, 2021, pp. 32-33). The difference between a political perspective on energy systems and a purely socio-technical, is that in the former the state is the main unit of analysis, because energy policies are adopted and implemented by the government on behalf of the nation-state. For the latter the state could be an ordinary economic actor or an external landscape factor, and not the primary analytical focus (Cherp et al., 2018). As mentioned, the state is the main unit of analysis in this thesis.

Lastly, scholars have also combined political economy, socio-technical systems and energy geographies. According to Bridge & Gailing (2020, p. 1038) a geographical political economy perspective helps understanding system's change as something more than "a set of socio-technical practices that unfold in different places". From a geographical political economy perspective socio-technical change is shaped by spatially constituted processes of for example innovation, accumulation or social mobilisation. The perspective also brings to light how these processes are spatially constituted through their interaction with each other (Bridge & Gailing, 2020).

Below I will describe 6 key themes from the political economy literature that I find relevant for my analysis.

2.2.1 How a country's political system influences energy pathways

In studies of energy systems the nature and role of the state has been important, with a key point being that different states have different resource endowments and capacity to create their own energy pathway (Newell, 2021; Power et al., 2016). A core objective of a political economy approach to energy is to understand interconnections between local, national, regional and international levels of energy production, markets and governance (Kuzemko et al., 2018).

The nature of a country's political system is of importance in shaping energy interventions and pathways. For example, varying degrees of democracy in decision-making play a role in how energy needs are identified and prioritised, which technologies are chosen and how pricing is determined. Who gets consulted or excluded, and their perception of energy needs, has a direct influence over energy policy decisions (Newell, 2021). Similarly, research on state-led energy projects has highlighted that decision-making processes around these projects are often unfair, because those most affected were not included in the planning or construction process (Siciliano et al., 2018). These tendencies are also visible in Nepal, in the local conflicts that have arisen around hydropower plants. In general, one could say that actors' choices around development models and energy investments are a core part of reproducing political power and promoting the interests of themselves and specific groups in society (Bridge et al., 2018).

Energy industries often are deliberately privileged in state policy, partly due to the power the industry acquires through the critical importance of energy for growth in the country. On the other hand, a state's desire for growth – through increased energy consumption – has historically also been coupled with expansion in the role of the state (Caldwell & Woolley, 1976 in Newell, 2021). However, the power balance within the state changes over time as state personnel and their expertise change, and there is thus a need of getting 'inside' the state, meaning to try to understand the tensions in state politics and not see the state as a unitary actor (Newell, 2021).

Despite the importance of state actors, other actors should not be forgotten when analysing the politics of system change, as Newell (2021) warns against. It would be difficult for state actors to implement top-down initiatives if important local, financial and market stakeholders are not participating effectively. This is because the non-state actors' technological and financial resources are often essential at project level, such as private sector developers of hydropower plants (Newell, 2021).

Energy pathways are at one end formulated by the state, and on the other end by multinational corporations, international organisations, transnational policy networks, regional and local authorities, and institutions. They all have their own agendas that shape the energy pathway, such as economic interests in a specific technology. Consequently, these types of institutions have some extent of power or autonomy in shaping the energy demand (Royston et al. 2018 in Newell, 2021).

2.2.2 Global capitalism, neoliberalism, and uneven development

To truly understand the role of the state in changing its energy system as well as the roles of other kinds of actors, an appreciation for context is required. This may be done by asking questions like "what is possible given enormous differences in capacity and resources, autonomy and uneven access to different energy sources and technologies?" (Newell, 2021, p. 143). The choice of energy systems and technologies, prioritisations around energy needs, and which actors are placed in charge are all functions of various political economies and decision-making processes (Newell, 2021). Contextual analysis is needed to understand the rationalities driving energy infrastructure investments and its implications (Bridge et al., 2018).

Political economy focuses on uneven development as a result of a global capitalist system (Bridge & Gailing, 2020; Bridge et al., 2018; MacKinnon et al., 2019; Newell, 2021). Geographical political economy perspectives, for instance, situates changes in energy systems within broader processes of capitalism, and discusses whether approaches to investments and national development of energy infrastructure should be state- or market-led (Bridge & Gailing, 2020; Bridge et al., 2018). This is clearly relevant for Nepal, which has been implementing privatisation policies since the 1990s, but still has a strong state authority steering energy development.

Some authors point to the state having lost some of its mandate within the energy sector as a consequence of having embraced economic liberalisation (Bridge et al., 2018; Kuzemko, 2019). Though states such as the UK might still make claims of the national importance of new energy projects and infrastructure. The claims come from a place of concern about increasing dependency on imports. An accompanying concern is that the energy system is no longer contained nationally, but is increasingly shaped by decisions on other levels. According to Bridge et al. (2018) governments scaling (i.e., place on national level) energy

as a national concern is also a reflection of their in reality limited capacity to deliver upon public concerns for affordability, energy security, and climate change, in a context of global liberalisations of energy markets. Similarly, according to Kuzemko (2019) political economy often 'blames' global neoliberalist policies such as withdrawal of state power, when explaining why governments are pushed to act as business partners within energy development.

2.2.2.1 Neoliberalism promoted by aid institutions

Neoliberalist policies have been imposed by powerful states and institutions and have consequences for energy systems (Newell, 2021; Newell & Phillips, 2016). Neoliberal policies have been defined as increasing the role of the private sector, restructuring public companies, and reducing public spending. The intent of these policies in the field of energy is to attract investment to the energy sector, extend energy grids to those without access, and provide financial stability (Newell & Phillips, 2016).

The World Bank has for decades implemented neoliberalist policy on energy development in developing countries. This has mostly happened through large loans for privatisation, networking for liberalising energy sectors, and setting conditions for providing financial support. Newell & Phillips (2016, p. 13) refers to this as "disciplinary neoliberalism", which is used to "discipline" or regulate states that adopt policies counter to prevailing neoliberal ideas. In Africa for instance, the World Bank started such electricity privatisation reforms and liberalisation of power sectors from the 1980s, and withdrew support to countries that had a more interventionist approach to regulating their own energy sectors. Even though the policies were intended to benefit the countries, the results in Africa were at best mixed (Bayliss & Fine, 2007 in Newell & Phillips, 2016).

One example of how neoliberalism is studied in political economy analyses is through a relational approach, meaning understanding the relation between global processes and international actors and state actors and outcomes, as done by Newell & Phillips (2016). They find that energy policy in Kenya is heavily influenced by processes of neo-liberalisations, and that relationships between actors on various scales shape the direction of policy. A relational approach makes sense for analysing energy sectors because the fixed location of resources, such as hydropower, connects specific places with transnational circulation of capital meant for resource processing towards energy generation (Bridge et al.,

2013). Global processes must therefore be understood not as external forces on the local energy system, but relationally.

2.2.2.2 Foreign Direct Investments

In combination with loans, the World Bank and regional development banks, such as the Asian Development Bank (ADB) have promoted FDI (Virtanen, 2006). Infrastructure such as electricity grids and power plants are seen as important for poverty reduction and facilitating economic growth, but requires large investments. Public-private partnerships have therefore been promoted to provide financing for infrastructure in developing countries. FDI is presented as complementary to the host government's technical, financial, and human resources, as well as in building government capacity. Furthermore, private sector projects are seen as more effective in implementation, more commercially viable, and environmental protection is more easily built into the projects from the start. In Lao PDR for instance, the partnerships for hydropower development have been organised in build-own-operate-transfer (BOOT) schemes. This means that a private sector company, for the duration of a concession period agreed upon with the government, constructs a utility and operates and owns it until concession ends, upon which operation and ownership is transferred for free to the government (Virtanen, 2006). Critics of BOOT-schemes claim that they are based on false assumptions, as the host government still bears most of the risk in high-risk projects, while the foreign investors will insure themselves against it through guarantees and subsidies from international financial institutions before getting involved. Another critique is that the real cost of projects, such as harmful environmental impacts, in the end will be borne by taxpayers or the state. Lastly, critics to BOOT-schemes suspect that the foreign investor does not have incentive to ensure the financial and technical viability of the project also after the transfer back to the host government (IRN, 1999 in Virtanen, 2006). Many hydropower plants in Nepal are financed with BOOT-agreements.

2.2.2.3 The political economy of large-scale hydropower

An example of energy development where international actors play important roles is the way states develop large hydropower projects that receive funding from multinational corporations and donors, particularly the World Bank (Hancock & Sovacool, 2018; Keating, 2018). Many hydropower dams in developing countries, including Nepal, have been funded

by donors such as the World Bank. This may be seen as a transnational aspect of energy projects. Transnationalisation can take many forms, cross multiple levels and involve a variety of actors, such as capital flowing over borders from bilateral donors financing fixed energy projects (Keating, 2018). Nepal is dependent on foreign investments to develop energy projects and accompanying infrastructure. Increased electricity production could benefit the entire host country and improve social equality, but when most of the income from building a dam goes to large multinational firms based in richer countries, the benefit for the countries is reduced. This is also the case if the electricity is distributed mostly to big domestic industries or elites (Hancock & Sovacool, 2018).

2.2.3 The autonomy of developing states

One important debate in political economy studies in developing countries is about the "policy space available to developing countries to pursue autonomous development pathways" (Newell, 2021, p. 41). This relates to the global capitalism and neoliberalism described above, and the power relations that impact processes of change in parts of the world where transnational businesses and donors play a large role in shaping the trajectory of the change. A political economy perspective helps describe the characteristics of power relations between forces external to the state and the state (Power et al. 2016; Newell 2018, in Newell, 2021, p. 41). According to Kuzemko et al. (2018), a political economy of energy overlaps with the political economy of development.

For countries with low influence on global trade relations, dependency on technical assistance and aid has reduced the policy space available for pursuing energy pathways most in line with national development goals. The possibility a state has to create independent energy pathways, and thereby their autonomy and developmental space, is affected by the degree of aid dependency, status as energy importer or exporter, trade ties, and opportunity to condition certain requirements on investors (Newell, 2021).

2.2.4 Power relations in energy development

Power and power dynamics are discussed within all the theoretical approaches used in this thesis. Any form of social and technological change is realised through power dynamics (Stirling, 2014). Power is difficult to define, but might be loosely thought of as the exercise of forms of social control, or more specifically as "asymmetrically structured agency", with

agency referring to the variety of capacities involved in shaping social action (Stirling, 2014). Another conceptualisation of power is as social groups and actors having conflicting interests and goals. With this conceptualisation change comes through power struggles, conflicts, lobbying, contestations, bargaining, and coalition building (Geels & Schot, 2007).

When looking at the state in relation to the global economy, political economy theory raises questions about how power works in the politics of systems change. The questions revolve around "where power comes from", "how it is held, sustained and reproduced", and "how, where, and when it might change" (Newell, 2021, p. 37). By placing questions of power in the centre of change, questions around distribution, procedure, participation, and representation, and the relation between them also becomes relevant. This helps to understand why some groups of society benefit more from energy policy than others, or why a policy is more responsive to certain social interests (Newell, 2021). Similarly, in relation to dam construction, power concerns stakeholders' differential ability to participate in decision-making processes around the dam construction, and consequently their ability to control or access the natural resources or their benefits. The stakeholders may be financiers, dam builders, governments, or the local population (Siciliano et al., 2018).

Issues of power are thus important in determining the winners and losers in the choice of energy pathways. Who holds the power influences the choice of energy technology, because they shape the visions and ideas of development policy and the way these policies are implemented. Upon implementation, power relations will also shape who benefits financially from the energy development, and who must take the cost, for example, if certain social groups are "sacrificed in the name of national economic development" (Newell & Phillips, 2016, p. 47).

2.2.5 Geopolitical factors in the field of energy

Geopolitics may be defined as "the influence of geography on the power of states and international affairs", with an emphasis on "the strategic importance of natural resources, their location, transportation routes, and chokepoints" (Overland, 2019, p. 36). Geopolitics describes how geographical factors like access to resources or territorial location shape both national and international politics (Blondeel et al., 2021). Energy geopolitics has been defined as the influence of geographical factors "on state and non-state actions to ensure adequate, affordable and reliable supply of energy" (Bradshaw, 2009, p. 1920). The

emphasis has often been placed on security around the supply of fossil fuels, but studies of renewable energies has become a new focus within geopolitics (Blondeel et al., 2021). It is also treated within political economy (Kuzemko, 2019).

2.2.5.1 The role of rising powers

China has become a global contender to traditional donors such as the World Bank. Some of the drivers that make China look for new markets seem to be found in the Chinese renewable energy industries and surplus production capacity (Power et al., 2016). Access to Chinese financing has the potential to create a geopolitical shift that might influence technology choice and political autonomy in states, as Newell & Phillips (2016) explain in relation to Kenya.

South Africa and Mozambique are other countries where China has been involved in energy sectors. In South Africa, China has increasingly taken the role of project owners, with financing from partly state-led agencies such as China Development Bank. China's priority for Mozambique's power system has been large-scale hydropower and transmission infrastructure (Power et al., 2016).

India is another newer international development actor, or "rising power", and has been competing with China over involvement in the energy sector of for example Mozambique and South Africa. For instance, the Indian High Commission to Mozambique stated in 2013 that they would be competing with China over markets and natural resources (Power et al., 2016).

China is less reluctant than the western donors to invest in fossil fuel projects and large-scale hydropower projects. Supported by capital from China and India, the development of large-scale hydropower in Mozambique has been heavily shaped by elites making decisions around institutions, technologies, and investments. The increasing power generation and sale to regional markets from independent producers has led to the emergence of "electric capitalism" in Mozambique, offering the elites of the country opportunities for capital. Despite both domestic and foreign investment in new energy infrastructure in South Africa and Mozambique, the level of energy poverty in both countries remains very high (Power et al., 2016).

Furthermore, the consequence of the increased involvement of "rising powers" like China and India, is a rebalancing of power in energy sectors away from the neoliberal orthodoxy of more traditional donors, and back to an increased resource nationalism in the developing states receiving aid. In other words, access to finances from these rising powers might be leading to a type of resource nationalism seen before the spread of neoliberalist policies (Newell, 2021).

2.2.5.2 Cross-border trade of electricity

The geopolitical risk of electricity systems based on renewable energy is highest if the country has a central grid interconnected to its neighbours (Blondeel et al., 2021; Overland, 2019). According to Overland (2019), increasing use of renewable energy for electricity generation will lead to increased cross-border trade of electricity. With electricity being harder to transport as it is or be converted to other forms of energy, compared to for example oil, it is more likely to be sold to neighbouring countries on long-term contracts. These contracts are required to finance the up-front capital expenditure needed to build the infrastructure for transporting the energy (Overland, 2019). Nepal is working hard to increase their export of electricity to India, for instance. It is therefore relevant to understand what geopolitical risks this might expose Nepal to.

Disruptions of oil and gas supplies have been used by countries as geopolitical weapons, and Overland (2019) reviews whether it is likely that this will continue to be used as a tool within renewable electricity trade. There are few previous cases of electricity being used as a foreign policy tool, which might be related to trade of solar and wind power creating more "symmetrical" relationships, as countries use this energy trade to balance out their grids (Overland, 2019, p. 38). Blondeel et al. (2021, p. 9) similarly writes that "Electricity trading will likely be more symmetrical than trade in oil and gas", because the electricity can flow both ways in the grid. However, they also point out the risk of electricity cut-off as a tool. Another risk comes with large-scale infrastructure projects, as these may bring issues such as transparency, indebtedness and sustainability (Blondeel et al., 2021).

Cooperative grid connections between countries depends on trust. Blondeel et al. (2021, p. 9) therefore concludes that renewable energy infrastructure and export could give "similar problems with fixed infrastructure and (inter)dependencies in relation to the physical security of supply" as that of fossil fuels. Further, they find that trade relationships for

renewable energy are more asymmetric and similar to the relationships for the trade of natural gas if one country is always the exporter and the other always the importer. Neither Overland (2019) nor Blondeel et al. (2021) includes hydropower in their reviews of renewable energy.

For countries with electricity grids that cut across state borders, another factor that may leave them vulnerable is price fluctuations in international electricity markets. This is due to profits from electricity sharing the same volatility as other commodities traded across borders. The interconnection makes the state vulnerable to the actions of its neighbour for example through the neighbour increasing their domestic supply and decreasing cross-border demand, or in the event of economic shocks such as embargoes and trade disputes. Significant price fluctuations in export earnings are thus possible with an abundance of hydropower (Hancock & Sovacool, 2018).

2.2.6 Pressure on energy sectors from climate change and environmental agreements

The global climate change regime, starting with the UN Framework Convention on Climate Change (UNFCCC), has implications for the development of energy systems in all countries (Graaf et al., 2016). The more recent Paris Agreement, as a legally binding treaty, has committed all parties to reduce their greenhouse gas emissions. While sustainable energy policy and transitions to renewable energy have been accepted as essential for decarbonising energy systems, it is a new and challenging policy area within political economy (Kuzemko, 2019).

International environmental institutions have played an important role in shaping environmental policy in developing countries, with their authority coming from a mandate to oversee the implementation of environmental agreements, and from their access to financial resources. These institutions and conventions, like the United Nations Environment Programme, Global Environment Facility, or Conference of the Parties (COPs), has increasingly sought to integrate developmental and environmental concerns. For example, the World Bank has been working on mainstreaming environmental concerns into development projects by insisting on environmental impact assessments in all lending programs. Despite of this, the World Bank is continuously criticised for not properly ensuring integration of climate concerns into projects. For instance, less than 30 per cent of their lending to the energy sector actually ensured such integration into projects, and less

than 50 per cent of their energy-sector portfolio included climate change considerations (Newell, 2014).

International environmental or climate agreements give legitimacy to the state, according to Bridge et al. (2018), Cherp et al. (2018), and Kuzemko (2019). For example, Cherp et al. (2018) argues that as nation-states have been given mandate from these agreements, it is at state level the most important decisions will be made to steer energy systems away from dangerous climate change. However, there is disagreement on the capacity of states to implement the agreements nationally. Bridge et al. (2018) doubts the capacity of governments to deliver upon public concerns around climate change, energy security and affordability of national energy, considering the current global context of liberalised energy markets. They also point out that even though the agreements are signed and ratified by states, they depend on their compliance (Bridge et al., 2018). Furthermore, despite of the increasing pressure internationally to integrate environmental concerns into development, some developing countries might be either unwilling or unable to address the challenges due to differences in autonomy, power, capacity and policy styles (Newell, 2014).

Some developing countries accordingly feel threatened that international environmental agendas could constrain opportunities for economic growth. Environmental issues have a precarious position on developing country agendas, as it is often displaced by problems assuming greater priority. Therefore, the importance of natural resources to the economic development of a country is likely to determine the country's position on specific environmental policies. For example, Brazil has long resisted calls to treat the Amazon rainforest as a heritage to humankind due to its importance to the economic development of the country. Other developing countries have a more opportunistic view on environmental policy, as something to be used to secure funding and new technology transfer (Newell, 2014). For example, in India renewable energy sectors hoped the Clean Development Mechanism would help obtain additional funds for solar power development, but got disappointed (Ulsrud, 2004).

Whether a developing state wants or does not want to implement environmental agreements into their energy policy, it remains a difficult task (Kuzemko, 2019). For most developing countries, a common challenge is materialising the resources and organising bureaucracy at all levels of governance in a way required for imposing the regulations, monitoring, and other demands from international environmental agreements. Implementation can meet barriers through variegated interests spanning different levels of governance (Newell, 2014).

Energy ministries often wield more power than the ministries of environment, labour, and health, due to the importance of energy to economic development. This may be reinforced by close relationships between ministries of energy and energy utilities, due to the ministries needing their support to fulfil key strategies of the state (Newell, 2021). One example is the stalled attempts of adopting a national adaptation plan in Kenya, due to failed effort to involve the ministry of energy (Newell & Phillips, 2016). Overcoming internal barriers and resistance and carrying the policies forward as such requires alliances, networks, and coalitions. Newell (2014, p. 266) therefore suggests that the more democratic the country is, or the higher the presence of environmental organisations that may work as "watchdogs" of the state, the likelier that environmental policy will be maintained and imposed.

2.2.7 Critique of political economy literature

The most relevant critique of the political economy of energy relates to the choice of level. There is a debate on what the right analytical lens for studying energy processes is. Though the most commons focus is the state, and connecting the national and global level, some authors such as Kuzemko (2019) point to a need for placing more focus on the local level. Graaf et al. (2016) points out that the authority and power of civil society are often neglected in political economy studies, as well as a need for better addressing the concept of energy justice within political economy (Graaf et al., 2016).

2.3 Combining Socio-Technical System's Theory with Political Economy Theory

In this chapter, I have presented different approaches to understanding energy systems and the different factors that influence them. I will summarise them here to show how I will combine them in a framework for my analysis.

The components of socio-technical systems I will use in the analysis are: 1) Policies and strategies, which are the regulations, laws and policies, both at national level and international level, that are a part of or that may influence the system. 2) Central technologies, which refer to the main technologies that actors in the system focus their efforts on. 3) The actors, who are those involved in the system – everyone from firms and policymakers to NGOs, households, and individuals – and how they interrelate. 4) The

system directionality, which is the trajectory of change in the system, for example increasing use of solar PV. Lastly, 5) narratives or discourses are also seen as important components in a socio-technical system, and these will be described in the second part of the analysis. Narratives are those working in the system, used to persuade, motivate, mobilise, and contest on issues related to the system change. Narratives are essential for policy work (Byrne et al., 2020; Geels, 2011; Lawhon & Murphy, 2011; Newell, 2021; Ulsrud, 2015, 2017). These components are included because they are suitable for describing a well-established energy system at a national level. I will use these ideas and concepts from socio-technical systems theory to map out the Nepalese energy sector and thus get an overview of the system that provides electricity in Nepal, and the dynamic interactions and processes of change in the system. This will be the first part of my analysis.

In the second and main part of the analysis, I will use a political economy perspective on energy. Here, I include political perspectives developed within socio-technical systems theory, with the intent to explain the processes influencing the Nepalese energy system. The most important themes from the political economy theory are: 1) The state, its political system and relationality to other political levels. 2) How global forces such as capitalism and neoliberalism, and the financing mechanisms they promote have influence on energy pathways and policy space in the energy development of a state. And lastly 3) how geopolitics with new international actors, and 4) international climate change and environmental agreements may both put pressure on or shape pathways of energy development in different ways (Blondeel et al., 2021; Bradshaw, 2009; Bridge & Gailing, 2020; Bridge et al., 2018; Cherp et al., 2018; Graaf et al., 2016; Kuzemko, 2019; Newell, 2021; Newell & Phillips, 2016; Overland, 2019). With this perspective, I hope to understand the political and economic mechanisms and processes shaping progress in the Nepalese system. These mechanisms and processes will be referred to as "contextual factors" or "factors".

One thing to keep in mind before further reading, is the connection between actors at different levels of the system. Though the system may be considered as Nepal's energy system, it contains both national, international and local aspects and actors. As mentioned, Newell and Phillips (2016) stress a relational approach to socio-technical systems. They consider it especially important for analysing energy sectors, where the resources are relatively fixed but connected to transnational capital, such as hydropower. With this perspective an external-internal or national-international dichotomy will not in a satisfactory

way bring out the complexity and fluidity of this energy system. This perspective also guides which aspects were included in the analysis. For example, some of the actors included as elements of this socio-technical system are international. Though one way to describe the system could be to solely include elements from within the state's borders, I find that some international actors are important parts of the system and therefore should be mentioned amongst the other actors. Thus scale, in terms of both the political levels of actors in the system and scaling of projects, will also be kept in mind in the analysis.

In sum, the analysis will bring together literature on socio-technical systems, political economy and energy geographies. In building a bridge between these bodies of scholarship I seek to conduct an analysis that attends to the major contextual factors that shape the progress of the energy system in Nepal.

3 Method and methodology

With the intent of ensuring rigour in my research and analysis, I will here present the methods and methodologies used. This is done to uphold my responsibility towards informants and others who participated in the study, as I will be interpreting and sharing their experiences. By being transparent I thus hope to make it possible for the research to be evaluated and scrutinized, so that others may have reason to find it trustworthy and reliable (Bailey et al., 1998; Braun & Clarke, 2006; Stratford & Bradshaw, 2016). This chapter will therefore provide documentation of each step taken in this research project, and as I go along reflect on the strengths and weaknesses of these steps and practical challenges the process faced. After presenting how data was collected, I will account for the ethical issues that arose during data collection. Then I will discuss my own positionality, and in the end present my analytical approach.

3.1 Qualitative research

Before starting this project, I already had some familiarity with the Nepalese energy system and its context, in terms of exciting projects and actors. I also conducted a literature review (as synthesised in the introduction), where the purpose was to get a broader understanding of how this topic had been researched before and what conclusions had been made. Furthermore, I talked with two researchers within the field about the topic and its relevance, and had discussions with classmates and supervisors to ensure a diversity of perspectives were included in my research. These may be considered part of what Stratford and Bradshaw (2016, p. 118) calls “interpretive community”.

Early readings of academic literature indicated some factors that influenced energy development both in Nepal and other developing countries. Based on this I narrowed down the research to focus on three contextual factors that could be of importance to the energy development. This is similar to what Blaikie (2007, p. 9) calls a “retroductive research strategy”, as it starts with an observed regularity, and seeks to uncover underlying structures and mechanisms that are responsible for producing this regularity or phenomena. To uncover the structures a hypothetical model must be made. Thus, my hypothesis was that financing, geopolitics and climate and environmental issues had important shaping effects

on implementation of the Nepalese energy strategy, and my project would be to see if this was correct, as well as how and *why*. With three factors I would be able to provide a rich account of my unit of analysis, but also display variation (George & Bennett, 2005).

Consequently, I would be studying *structures*, and how they maintain and enable behaviour by individuals in the energy system. This research problem therefore falls under what Winchester and Rofe (2016, pp. 5-6) considers one of the "fundamental questions tackled by qualitative researchers", being: "What are the shapes of societal structures, and by what processes are they constructed, maintained, legitimized, and resisted?". In this case the structures to be analysed are social, economic, political, and environmental, and when trying to understand the "how and why components" of the issue - why actors act as they do or hold their opinions, what produces change, and in what context – then 'intensive' or qualitative research is the most suitable approach (Stratford & Bradshaw, 2016, p. 120). Furthermore, I found a qualitative approach to be suitable because the phenomena I was interested in – the process of increasing the electricity generation of Nepal and the contextual factors shaping them – are difficult to measure or describe quantitively (Sovacool, Bambawale, et al., 2011).

Mainly two things influenced my choice of research methods. Firstly, I was concerned with including a variety of perspectives in my research, both from domestic actors that have experienced the long periods of energy deficiency, and from international actors that are working in the Nepalese energy sector. One way to understand structures is through information from the individuals who try to influence and are influenced by the structures, which points to interviews (Winchester & Rofe, 2016).

Secondly, I knew well in advance of data collection that the global Covid-19 pandemic would make it very difficult to travel to Nepal and do a physical fieldwork, though it was my preferred choice. I therefore had to choose methods that would take both of these things into consideration, and thus landed on doing a 'digital fieldwork' from Norway, meaning online interviews, as the main method. As my three factors directs data-collection mainly to connection between state-level and a global level, I did not think I had to adjust the research questions despite of having to conduct interviews from Norway. With digital interviews I was of the impression that I would be able to access approximately the same people as if I had been present in Nepal, especially since the pandemic has made online meeting tools more available and common than before. When initial interviews proved this assumption to be correct, I stuck to the method and research questions.

3.2 Case study

The research design of this thesis may be considered as a qualitative case study. While a case can be defined as "examples of more general processes or structures that can be theorized" (Stratford & Bradshaw, 2016, p. 121), a case study can be defined as "an intensive study of a single unit for the purpose of understanding a larger class of (similar) units" (Gerring, 2004 in Baxter, 2016, p. 130). However, case studies as a methodology are also guided by the assumption that in-depth understanding of a phenomenon is valuable in its own right, meaning generalisability is not a requirement. Another way to explain case studies, which I find suitable to my case, is as an investigation of a phenomenon within its context, to explore causation, and thus find underlying principles. The intention is thus to find more accurate understandings of complex issues, and provide contextual and detailed insights (Yin, 2003; Baxter & Jack, 2008 in Sovacool, Bambawale, et al., 2011, p. 255).

As mentioned above, the choice of contextual factors to investigate was informed by theory as well as pre-existing knowledge on the phenomena. Case studies are suitable for supporting or falsifying existing theories, or developing new theories (Baxter, 2016). Yin (2003 in Baxter, 2016) finds that case studies are distinguished from other approaches by a thinking that theoretical propositions should be stated prior to data collection, which is more of a deductive logic. However, Baxter (2016) cautions that qualitative case studies are often used to research under-explored phenomena, meaning that a purely deductive approach might not be appropriate. As already mentioned, early readings proved that this was the case for Nepal as well. Lastly, according to Sovacool, Bambawale et al. (2011), inductive case study approaches are widely used within energy policy, because it gives insight into the dynamics of energy programs and public acceptance of energy technologies, which is similar to what I was looking for.

The case study or phenomena in this thesis is the progress of electricity development in Nepal through strategy implementation and other efforts, from the 1990s until present time. The strategy, which is a part of the phenomena, is a combination of parliamentary ratified policies, white papers, acts, regulations and 5-year plans which all constitute Nepal's grand plan of developing the country through electricity development. The cases of 'implementation' are several large-scale hydropower projects. Before data collection began, I selected three projects that could be used as examples within the larger case, as they are developed with the purpose of reaching the energy strategy of the state.

The selection of project examples was made based on knowledge from previous research in Nepal, early readings, and news articles. Though there are other project examples that similarly well show the complications of Nepalese energy development, all three were large-scale hydropower projects planned or constructed within the right timeframe, and which can be considered as relevant for Nepalese energy development today. During interviews I checked my interpretations with informants, such as discussing whether the hydropower plants I had chosen were relevant and somewhat representative cases. Such checking procedures are according to Stratford and Bradshaw (2016) an important step to ensure rigour.

One additional project kept reoccurring during interviews and in the end, I also included it because of its historical importance for both strategy and implementation in Nepal. That both an additional factor and an additional project were included after data collection commenced, is similar to what Baxter (2016, p. 138) considers a cyclical approach, where the initial hypothesis is stated loosely, then explored through the real-life cases of strategy implementation, which opens for unexpected insights and potential contributions to theory development. It is also similar to what George & Bennett (2005, p. 21) calls a "theory-laden" approaches to case studies, rather than "theory-determined".

3.3 Data collection

The two main elements of this case study are thus Nepalese energy strategy documents, and hydropower projects that can exemplify challenges around implementation. The data-collection around these elements was conducted from the autumn 2021 to spring 2022. As the research was conducted within one block of time it can be considered as a "cross-sectional" case study (Baxter, 2016, p. 139).

3.3.1 Selection of Informants

I used several strategies considered as "purposive sampling", to make sure I obtained a broad range of perspectives and covered all of my three contextual factors (Stratford & Bradshaw, 2016, p. 124). All contact was done via e-mail. The first two informants were suggested by my co-supervisor, and these again provided me with e-mail addresses of other relevant people. I also used contacts from my bachelor thesis fieldwork to gain access to relevant individuals in state agencies, when they were hard to reach. This method can be

called “snowball sampling” (Stratford & Bradshaw, 2016, p. 124). For my hydropower examples, I sought out people who had been involved in these projects from both the governmental and developer side. I did this by sending e-mails to the company or agency webpage, directly to individuals if their e-mail address was provided, or to contact points if that was the only option. Stratford and Bradshaw (2016, p. 124) calls this “criterion sampling”.

In total I performed 14 in-depth video interviews and one phone interview of on average one hour. I also conducted one e-mail interview and sent follow-up questions on e-mail to several informants after interviews. All of this was done between November 2021 and March 2022. These informants included two Nepalese private sector developers, four Nepalese state officials, one Nepalese and one Norwegian researcher, one advisor from a Norwegian aid agency, one Norwegian private developer, one Norwegian consultant, the Counsellor and two advisors for two different European embassies, two people from a regional cooperation association, and one from an international finance institution. All of these had long experience in the field. This made it possible for me to bring forth conflicting and differing perspectives. For an overview over all informants and what they will be referred to, see Attachment 1.

3.3.1.1 Challenges on recruiting

Generally, recruiting informants was a time-consuming task as most of the e-mails I sent remained unanswered. As calling from Norway to Nepal would have been too expensive, recruiting by phone was out of the question. Consequently, the selection of informants was in some instances a result of who replied. Especially for the private developer side, it was very hard to find out who to contact. For example, Statkraft has not been directly represented in Nepal in a long time, as they in the Khimti-project where a part of the SN Power constellation and further in the Himal Power Ltd (HPL). Company. For Tamakoshi III they were represented through HPL. Similarly, for the Indian company developing the Arun III project. Though I could find webpages from the companies, locating who it was relevant to contact was not easy, and actually failed as I never got a reply to my e-mails. This despite several attempts. Similarly, for the new constellation of Tamakoshi III, I never got a response, and no other informants could direct me to contacts within the companies. I believe many of these difficulties were due to complicated ownership structures in private companies. In the end four of the interviews were with people who had been more or less

directly involved in the hydropower projects. However, almost all informants had knowledge of these projects, and I could add on information from news articles and literature. Another challenge was to get in touch with the right state agencies. Though e-mail addresses often were listed on their pages, it took much time and effort to arrange interviews, and in the end, I did not have enough time to get interviews with planning authorities such as the Ministry of Energy. I did, however, get interviews with four other important state agencies, some of which are under the Ministry.

Though I knew well in advance of starting data collection that it would have to be conducted digitally from Norway, the Covid-19 pandemic also caused challenges throughout data collection. For example, just like Norway, Nepal was hit by a wave of the Omicron variant. This happened in the middle of my data collection period and meant that several informants had to postpone interviews due to themselves or their workplace being infected. In some instances, the interview never took place. Many potential informants seemed to have challenging situations to handle. This raises some ethical concerns around whether it was suitable of me to get in touch. However, the 'wave' was soon over and those who did reply and agree to interviews did not seem too concerned.

3.3.1.2 Strengths and weaknesses around informant group

One potential and unintentional issue with the collected data is a bias or lack of representation among informants. Out of my 16 informants, only two were female - both researchers. I often tried to specifically contact women in the institutions I wanted to speak with – which were not many, but I rarely got a reply. What I would consider the main reason for this issue, is that Nepal is a highly patriarchal society, and that there in general is a lack of women in the energy industry and politics. This issue thus leads back to structures and characteristics of the country, making it difficult to create a better balance in the data with my topic of research. I also found out after data-collection that 11 out of 16 informants were engineers – even the ones in regulatory positions. 10 out of 17 were Nepalese, 5 Norwegian and 2 from Middle Eastern countries. The potential consequences of the underrepresentation of women and other groups in the collected data is that important perspectives might have been lost, meaning the data is biased and only represent a partial understanding of the case (Johnson & Madge, 2016; Rosser, 2008).

The Norwegian informants were more accessible to me. This is similar to what Stratford and Bradshaw (2016, p. 124) calls “convenience sampling”, meaning selecting participants on the basis of access. However, the relatively large number of Norwegian informants also reflects the fact that Norway, in the form of bilateral aid and commercial investments, has been important in the Nepalese energy system for the time-period I am studying. These informants had long experience with the Nepalese energy system.

On the other hand, a strength of the data is that I was able to access informants from a wide range of institutions, and thus better bring out differing perspectives on the strategies and cases of implementation, such as on the four different hydropower plants. This made it easier to understand and analyse the context of the energy system, which according to Stratford and Bradshaw (2016) is a typical emphasis of qualitative research, and the sample therefore does not need to be completely representative.

3.3.2 Interviews

Qualitative interviewing is based on the assumption that people’s perspective is meaningful and knowable, and thus the purpose of the interviews is to find out things that the researcher cannot observe, from people who lived and observed them (Patton, 2002). Furthermore, understanding culturally complex perspectives often requires in-depth interviewing, which in turn contributes to a detailed appreciation of complex issues (Stratford & Bradshaw, 2016).

A general interview guide was discussed with a co-supervisor and was later slightly adjusted to each interview. However, the structure was always similar, starting with questions about the informant’s current participation in the energy sector, followed by questions about the energy strategy of Nepal, and who had been involved in making the strategy. Then followed questions that fell under the chosen factors and about the relevant energy projects. I would also ask informants to explain what kind of actors or institutions had been involved in the various projects or processes, as part of the energy system mapping. In the end I would always ask if the informant wanted to add something.

A combination of approaches was used throughout data collection. In the first and more exploratory phase of data collection a more conversational approach was taken. This would better allow me to explore and go deeper into the information the informant considered relevant, and thus in a way a more inductive approach. Patton (2002, p. 342) calls this “the

informal conversational interview", and this was particularly useful to discover contextual factors before deciding on the 4 I focused on in analysis. Mostly the interview guide served as a checklist to make sure all the topics I wanted to cover where included. This is similar to what Patton (2002, p. 342) calls "the general interview guide approach", where you outline issues to be explored before the interview. For interviews where more specific information was sought, such as the interview with NEA which was also the last interview, the interview guide was more thorough and checked more often during interviews. This is more of a "standardized open-ended interview" (Patton, 2002, p. 344).

A challenge with not following a very strict interview guide is that uncovering patterns in the responses becomes more time consuming, as patterns emerged at different points time in the interviews. However, as I was actively looking for different perspectives from informants, a more conversational and flexible approach made it easier to be sensitive to situational and individual differences in the informant's responses (Patton, 2002).

All interviews were conducted over Zoom, apart from the informants who requested Teams. Digital interviews and e-mail interviews might be considered as "computer-mediated communication" (Dunn, 2016, p. 179). Thanks to online tools I was able to conduct the interviews from Norway. There is a debate around whether online interviews makes it easier or more challenging build "rapport" with the informant (Järvinen & Mik-Meyer, 2020, p. 14). For most part this did not appear to be an issue in the interviews, as they were conducted in real-time and myself and the informant could see and hear each other. What I rather experienced was that doing interviews online allowed informants to more freely choose a time that suited them, such as conducting the interview at home in the evening. On the other hand, one informant took the interview while travelling in a car, which created much disturbance and made it harder to concentrate on follow-up questions.

For some informants I sent follow-up questions, for example if something remained unclear or if the interview had to be stopped early and some questions had remained unanswered. One interview was also done completely by e-mail, which I found to be a very useful method as I had some very specific questions and the informant answered thoroughly. This is similar to the benefits of e-mail interviews, as pointed out by Järvinen and Mik-Meyer (2020), that it gives the respondent the time to reflect more over their reply, and the possibility to reply when it suits them. On the other hand, some of the follow-up questions to informants after interviews were not answered and other times such short replies that they were useless for analysis. This is similar to a challenge with e-mail interviewing as also

pointed out by Järvinen and Mik-Meyer (2020), that e-mails leave less room for clarification of questions or answers.

3.3.2.1 Challenges on interviewing

Poor internet connection either from my side or the informant caused interruptions in nearly half of the interviews, but for most of the interviews we managed to finish as planned.

Generally, language has not been a big problem in this thesis, as the people I spoke to could speak English and as my own is generally sufficient. However, for some informants who were not conversationally fluent in English it was hard to understand my questions, (though this might also be due to poor formulation of questions) or it was challenging for me to understand exactly what they meant. Consequently, some content might have been lost due to language issues.

3.3.3 Recording and transcribing

Most of my interviews were recorded. I did the recordings with UiO's app for recording, "Nettskjema diktafon", which sends the recording directly to a secure University server. One challenge with this app, in combination with video-interviews, was that the sound turned out rather bad, which made it harder to transcribe. I took notes by hand, which I immediately after the interview cleaned up and transferred to my computer. I transcribed the recording later and thus received a relatively accurate account of what was said, unless there were audibility or language issues.

In the cases where I either did not receive approval to record the interview, or if the interview happened over the phone and recording was unpractical, I took notes directly on my computer, to get down as much information as possible. I fixed these notes directly after the interviews. This means I could get a quite accurate transcript, and save a lot of time on transcription, but it also means that the text is less accurate and that citing during analysis had to be done with more caution. It was not possible to write down a word-by-word account during the interview, and it was harder to ask good questions as my focus was more on writing.

3.3.4 Documents & Secondary data

The secondary data used in this thesis was mostly found in three ways. Firstly, by searching for keywords related to my topic on Oria.no – the University of Oslo's online library – with combinations of words like "energy" "Nepal" "hydropower" and "politics". Secondly, the data was found using the reference list of initial articles. Thirdly, researchers within the field that I spoke with before and during data collection sent me articles that could be of relevance to me.

According to Asdal (2015), documents are important beyond the actors who wrote them and the words they say. They also display important things about the context they were written in, and how the texts may in turn modify its context or the issue it describes through the cooperation of the texts' writers. This is very relevant in Nepal, where government strategies, partly represented in white papers and plans, even in periods of severe energy shortage, had a wording and ambitiousness that perhaps did not reflect the situation in the country. This, combined with the need of understanding state's strategy, represented in official targets and plans for energy generation, made it relevant to read and make an overview of all relevant policy documents, legislations and Acts that are available in English in the pages of various governmental bodies in Nepal – 25 in total. An overview of the most relevant will be given in Part 1 of the analysis chapter.

3.3.4.1 Strengths and weaknesses on documents

A weakness of this data was that the main official energy strategy from 2018, which Nepal is following today, has unfortunately not yet been officially translated to English. As the document was not easily translated, and few good sources summarised the key points of the document, I mainly had to rely on what informants said about the strategy. The implication is that some of the information might not be entirely accurate, or might have been coloured by the informant's interpretation. I tried to account for this issue by checking the information I received against other sources, but I find it an issue that I could not myself read and check the wordings and numbers of the paper myself, as it is a key text for the Nepalese strategy and thus this analysis. Further, some policy papers in Nepal I could not use as there were no English translations accessible. I might also add that in general, finding reliable and updated numbers on for example energy supply and consumption in Nepal was a great challenge.

3.4 Ethics

As a researcher I have a responsibility to the people who were involved in this project, and consequently need to consider the research ethics of the data collection and analysis (Dowling, 2016). The ethical practice of researchers is in Norway regulated by the Norwegian Centre for Research Data (NSD), and my application to conduct this project was approved by NSD October 7th 2021, before data collection was initiated. Research also needs to be in line with the General Data Protection Regulation (GDPR). The personal data that was collected consist of names and employer, which for the most part was provided on the employer's website. The most sensitive data was the interview recordings, which on the recommendation of the university was collected and stored through the University's app "Nettskjema Dictaphone" (UiO, 2022).

In the NSD-application the information letter that all informants received via e-mail was also approved. The information letter was used to inform participants about what it would mean to participate in the interview – i.e. the purpose of the project, how recordings would be stored, and that it was voluntary to participate. I asked for approval to do recordings before the interview via e-mail, along with information about the purpose and security around recording, as well as attaching the information letter again if some time had passed. I did not require participants to sign the information letter, however I did require an explicit confirmation by e-mail that I was allowed to record, to ensure that they were properly informed. Dowling (2016) calls this "informed consent". In one instance the informant did not receive the letter before the interview, and that is because the interview was spontaneous. I therefore did not record, but did send the information letter and asked for approval to use the notes from the interview via e-mail afterwards. In two instances the informants had not replied to the question about recording in e-mail before the interview. I therefore asked again when we met for the interview, and both of them gave their oral consent to be recorded.

To protect informants, they were all anonymised in the thesis and in my stored documents. The exception was their workplace, as this was deemed of relevance to their perspective. This was written in the information letter. For smaller workplaces or for example for the different Norwegians working in Nepal, there is thus a risk that they could be recognised. I always started interviews by repeating information about the purpose of the project and asked them to contact me if they had any concerns.

3.5 Positionality

Issues of power are always present in research, as it exists in all social relations (Dowling, 2016). All the interviews in this project were with what can be considered "experts" or "elites" - policymakers, academics and developers, all with the power to influence their field. It therefore becomes relevant to discuss power relations in interviews. The relationship between myself and the informants may be considered asymmetrical, meaning there is a difference in the social position of the researcher and the subject. In this case, it was generally the informants who could be considered as in positions of greater influence due to their access to cultural and financial resources, or their influence over policy processes, and myself as a young, female student (Dowling, 2016). This may be called "studying up" (Ostrander, 1995 in Smith, 2006, p.643).

A common claim regarding interviewing elite groups is for example that they "are better positioned to manipulate research results and dissemination" (Smith, 2006, p. 643). Though Smith (2006) declines this conceptualisation of power compared to more symmetrical interviews, I did reflect on several things that might be more in tune with the first perspective. For example, one Norwegian informant admitted humorously that "I am trying to influence you now", to agree with his perspective on the benefits of private sector investments in the Nepalese energy sector. Though my background in critical developments studies and human geography in a way has 'trained me' to be critical of what large institutions and corporations conduct in developing countries, I tried to be aware of how such comments may have made it more difficult to maintain an effort at objectivity in data collection and analysis. When reflecting over this example, I also noticed how theory work provided a good balance to what informants were saying, as it helped me keep a broader and global perspective on what is ongoing in Nepal. Thus, I can say that theory informed the analysis in a variety of ways.

One way the informants did influence the project was through inclusion of the fourth hydropower plant as project example. Especially the Norwegian informants were adamant that this plant and the process around it was consequential for later developments in the system. I therefore decided to include it, as it fit well with one of the themes of the analysis and gave good historical context.

Another issue on power relates to a downside of digital interviews, as well as my research questions and what level I chose to focus on in research. They gave little room for including

the people in Nepal who are affected the most by the energy developments, such as those who has little or no access to energy, or those who live right next to large-scale hydropower plants. I spent much time reflecting over this lack of balance in perspectives included in the project, especially since one of my motivations for going into this subject comes from my Development Studies-background, and knowledge on how local populations are affected by energy projects. I tried to account for this issue in two ways. Firstly, by interviewing local village committees and municipalities where the hydropower plants are placed. This did not pan out, as none of these institutions replied. Secondly, I included local issues around hydropower plants as a theme, to display that there is contestation around the plants, and that these conflicts have an influence on energy development. These strategies have semblance to the second way Dowling (2016) writes that researchers respond to power imbalances, meaning to actively involve those of less power in the research.

With presenting these reflections I hope to display what Dowling (2016, p. 34) calls "critical reflexivity". If you as a researcher cannot directly account for power relations in your research conduct, an important response becomes to at least recognise those power relations, and how it influenced the research. This is also one way I have worked to ensure rigour throughout the project – by checking my own work and reflecting on my role as a researcher. Critical reflexivity is about the researcher's self-understanding or self-evaluation of the research they conduct, and provides one way of validating findings in qualitative research (Bailey et al., 1998; Cope, 2016). Bailey et al. (1998) highlight that this must be applied to every stage of the research. One way of making sure I was reflecting on the research process was through writing memos – notes written in a document, almost daily about what I was doing and why during the entire research project. The memos could for example be reflections of patterns that I discovered, contextualisation of events, evaluating things that informants said during interviews, or forging new links between codes and themes. I found the memos to be a very helpful tool for interpretation as the project developed. They were also helpful for remembering connections I made or thoughts that I had, such as around my own positionality in relation to my informants or biases in the data (Cope, 2016).

3.6 Methods for analysis

Thematic analysis is a foundational method for qualitative analysis, which I used for identifying, organising, interpreting, and reporting patterns in my data, called themes. A great benefit of the method for someone like myself with limited experience, is that it is relatively easy to use. It was made easier by following the steps of Braun and Clarke (2006), to guide me to making informed choices throughout analysis. The steps are 1) familiarising yourself with the data, 2) generating initial codes, 3) searching for themes, 4) reviewing themes, 5) defining and naming themes, 6) producing the report. I found that thematic analysis was suitable to combine with my political economy perspective, as they are both independent of epistemology, and as the combination made it easier identify patterns in how informants talked about the energy sector and project development, and to compare these with themes from theory.

As an important first step of the analysis, I had transcribed all interviews to turn them into textual material ready for analysis. Interpretation starts already during data collection. The transcripts were all anonymised, and together with the one e-mail interview and other follow-up e-mail questions uploaded to Nvivo. Nvivo is what Cope (2016, p. 388) calls «computer-aided qualitative data analysis software» (CAQDAS), meaning tools meant for text retrieval, coding and theory building. I found the main benefit of Nvivo to be as an organisational tool, as it made it easy to sort and retrieve the data, especially as I was looking at several cases.

Before starting the coding in Nvivo I already had my ‘hypotheses’ about the three factors influencing energy development in Nepal. These may in this thesis be seen as the main themes, and where constantly informing the analysis. Based on reflections from interviews I made a list of sub-themes I thought would be identified during coding, with the purpose of later being able to check my assumptions about the material. When I started the initial coding, I took a more open and inductive approach, to let the data speak without being too heavily informed by theory, and thus let new themes be identified. One such theme was the characteristics of the Nepalese state, which was brought in as a main factor or overall theme after initial coding. This is similar to the mentioned ‘cyclical’ or ‘theory laden’ approaches, and was done with the intent of allowing for more theory development through analysis (Baxter, 2016; George & Bennett, 2005).

Coding itself is a system to organize data, such as bits of text, retrieving it by studying all these bits of text together, and finally analysis. Coding is according to Cope (2016) an important way to display critical reflexivity. And through coding my data, I hoped to grasp the varying opinions the actors had on various issues (Dunn, 2016). I used Nvivo to categorise all the text into useful 'groups' of text, i.e., initial codes. Many of these initial codes can be seen as "descriptive codes", as they were either directly related to things informants said or reflected patterns on the surface. As a fourth step, through making connections to theory, these more descriptive codes were developed into "analytic codes" better reflecting the main factors I was interested in (Cope, 2016, pp. 378-379). I found coding in Nvivo to be most useful in the first stages of coding, and mostly used it as place to keep the organised text afterwards. It was also a helpful tool to organise my socio-technical system mapping, as I could easily organise for example who actors where and what they did into separate folders. In a way, these can also be seen as "analytic codes", reflecting an already important theme coming from theory. I started writing already after the first round of coding, and used the writing to do the fifth step of Braun and Clarke (2006) – defining and naming the themes.

4 Empirical analysis

This chapter has two main parts. The first part describes important characteristics of my unit of analysis, the electricity sector of Nepal. I analyse the sector as a socio-technical system in order to understand which social and technological elements it consists of, and their interrelations. The second and main part of the chapter presents findings on different kinds of factors that play a role for how the system works for increased electricity generation in Nepal. Thus, part 1 describes the current situation, including ongoing processes of change, and part 2 explores possible explanations of this situation in terms of important "factors" or mechanisms at different geographical levels that influence the situation. Here I use the second part of my framework for analysis. I will thus emphasise the role of different sources of financing, geopolitics, climate change and environmental issues, and lastly the role of state characteristics, as factors shaping the energy system and its progress.

4.1 Part 1: Understanding the electricity system of Nepal as a socio-technical system

As described in the theory chapter, an energy system can be seen as a socio-technical system which includes rules, norms and conventions that guide the implementation of certain technologies, and the practices of the actors in the system. This section describes the Nepalese energy system as a socio-technical system, inspired by the authors mentioned in the theory chapter and the framework of analysis (Byrne et al., 2020; Cherp et al., 2018; Geels, 2011; Geels & Schot, 2007), as explained.

4.1.1 Policies and strategies for increased electricity generation in Nepal

Policies and strategies here refer to the regulations, laws and policies, both at national and international level, that can be seen as a component of the socio-technical system of electricity generation in Nepal. While some of the policies are coming from key system actors themselves, others may be seen as part of Nepal's policy environment.

4.1.1.1 The current governmental strategy

The current official and parliamentary ratified strategy for electrification in Nepal is a government white paper from 2018. It is decided by the government and used to direct the state's work around electricity generation (NEA employee). The main target of the paper is increasing total installed electricity capacity from 1000 MW to 15,000 MW in 10 years, i.e., by 2028 (Trace, 2019). A certain quota is designated for each of the electricity technologies in the strategy. Of the total capacity, 35 % of the generation shall go to run-of-river (RoR) hydropower projects, 30 % for peaking RoR hydropower, 30 % storage or reservoir hydropower projects, and the last 5 % must come from solar, wind or other non-hydro renewables (Informants from ERC and NEA). Finding updated numbers for how these quotas are filling up was not possible, except that the RoR-quota is already full in terms of issued PPAs (NEA employee).

The 15,000 MW of new electricity generation capacity is supposed to meet internal demand, as well as make 5000 MW available for export to India, and some to Bangladesh (ERC Commissioner). Until export is possible, the plan is to increase the per capita electricity consumption fivefold, first from 300 kwh to 700 kwh in the first two years, and by 2028 raise it to 1500 kwh per capita. Since 2018, the government has been conducting awareness programs and other efforts to increase consumption (AEPC officer). For example, thousands of electric vehicles have been imported by the state, and NEA are developing charging stations. Private developers have been included to increase the use of induction cookers, and industries are seeing diesel and petrol replacement (IPPAN member). NEA has also been pushing the move away from LGP-use over to electricity-based technologies through subsidies (Climate Advisor).

The strategy is also to provide adequate and affordable energy to all the provinces, and thus move from the current 92 % with access to electricity to 100 % of the population by 2028 (Informant 1; WB, 2018). Recent tracking shows that progress on access is in line with the target (Energy Advisor; ESCAP, 2021). Increased access is planned to be achieved by increasing both domestic and private sector participation in hydropower project installations, and the 2018 white paper therefore included policies to make it more lucrative to invest in Nepal, such as various incentives for the developers (IPPAN member and ERC Commissioner). A Norwegian consultant pointed out that facilitating for private sector participation in the production side of the system "has been a mantra they have had all along".

Other plans that are still applicable and coincide with the 2018 white paper is Nepal's 15th five-year plan from 2020, and the SDGs from 2015-2030 (Informant 1). And in addition to plan documents, narratives and visions are used by different actors to promote and substantiate the energy strategy and are important parts of socio-technical systems (Byrne et al., 2020). How these visions are turned into a narrative and used as a political tool will be revisited in a section of Part 2.

4.1.1.2 Former policies and strategies from the state level

The most important documents from state level seems to be: 1) The Electricity Act from 1992. This Act opened for private sector investments – both domestic and foreign - to the Nepalese energy sector, starting with the Khimti I power plant (GoN, 1992; Norad Advisor). 2) The Hydropower Development Policy of 2001. This policy was pointed to as important by a Norwegian consultant. Among other things, it announced to "utilize the hydropower potential to meet the domestic demands of electricity" (WECS, 2013, p. 38). 3) The 2013 National Energy Strategy of Nepal (WECS, 2013). 4) The White Paper from 2018 and 5) The Fifteenth Plan from 2020, as mentioned, are central documents. The latter is a plan for all sectors of Nepal, with the "long-term vision of fulfilling the shared national aspiration for "Prosperous Nepal, Happy Nepali" by making Nepal a high-income country by 2043" (NPC, 2020, p. Foreword). Almost all the documents mentioned here are strongly related to hydropower development. Table 1 shows these and some other relevant policies and laws for energy development from the Nepalese state.

The largest difference between previous state policies and goals seems to be the level of ambitiousness. "They all say the same things. Some say 7,000 MW, some say 15,000 MW, some are maybe saying 20,000 MW. That is the only difference", the IPPAN member explained. The strategies have all been very focused on increasing national hydropower production capacity within a certain number or years, or as the Nepalese consultant put it "The strategy is all supply-driven". Apart from that the plans have been "in many ways, pretty similar", and they have not been reached thus far (Norwegian consultant). The supply-orientation of these policies were further strengthened when the new government came to power and had the 2018 white paper ratified in parliament (Nepalese consultant).

Table 1: List of Nepalese energy policies, regulations and acts relevant to the energy strategy and hydropower development

Policy/Regulation/Law	Made by	Year
Nepal Electricity Authority Act	Government of Nepal (GoN)	1984
WATER RESOURES ACT	GoN	1992
ELECTRICITY ACT	GoN	1992
Hydropower Development Policy	GoN	2001
National Water Plan 2005-2027	GoN / WECS	2005
Rural Energy Policy	GoN / Ministry of Environment	2006
National Energy Strategy of Nepal	GoN / WECS	2013
Renewable Energy Subsidy Policy	GoN / Ministry of Population and Environment	2016
Nepal Constitution	The Constituent Assembly of Nepal	2015
White Paper on Energy, Water Resources and Irrigation Sector's Current Status and Roadmap for Future	GoN / MOEWRI	2018
National Energy Efficiency Strategy	GoN / MOEWRI	2019
The Fifteenth Plan (Fiscal Year 2019/20 – 2023/24).	GoN / NPC	2020

4.1.1.3 Relevant documents on the international or bilateral level

Nepal has signed several international agreements on climate change, which can be seen as part of the system's policy environment. One of them are The National Adaptation Programme of Action (NAPA). According to Wahid et al. (2016, p. 63), it shows how the government identified «the development of its rich hydropower potential and the integration into the South Asia regional power market as key strategies for ensuring universal access to a sustainable, reliable, and affordable power supply in Nepal». Nepal is also a signatory to The Sustainable Development Goals and the Paris Agreement (Informant 1 and 5). The Intended Nationally Determined Contribution (NDC) from 2016 and Second NDC from 2020 are also relevant, and will be addressed later.

Nepal and India have entered treaties, agreements, and 'Memorandum of Understanding' (MoUs) around power trade through time, and these may also be seen as comprising the policy environment. Some of them are The Treaty of Peace and Friendship from 1950, the 1954 The Koshi River Agreement from 1954 and the 1959 Gandak River Agreements, which all were highly controversial in Nepal. In addition, the two countries have discussed shared water projects to be constructed as joint ventures, such as The Pancheshwar Project, which did not move forward for 13 years. Power trade agreements, like the Nepal–India Power Trade Agreement from 1996, supposed to move from Nepal importing from India over to India importing from Nepal over the course of 25 years was also halted due to the "complicated relationship" (Sharma & Awal, 2013, p. 691). Some of the most relevant today are the "Guidelines for Import/Export (Cross Border) of Electricity- 2018" – an update of a guideline from 2016 which formally allowed Nepal to export to India, as well as import (MoP, 2018; TKP, 2016). The Guidelines were sent to me by a Cicero-researcher as an example of India seeming open to imports from Nepal. The agreement between NEA and an Indian counterpart in 2017 was important in the end of the load shedding period, as it opened for more electricity import to Nepal (Subedi, 2017). Importantly, there is the "Procedure for approval and facilitating import/export (cross border) of electricity by the designated authority", which was issued by the Indian equivalent of NEA, and which will be addressed later in the chapter (CEA, 2021). Lastly, agreements signed under the SAARC, such as the "SAARC Framework Agreement on Energy Cooperation" from 2014 may also be seen as a part of the policy environment (SAARC, 2020b).

The World Bank has also initiated many plans and documents for Nepal that may also be considered as a part of Nepal's policy environment. Such plans can be Hydropower Master

Plans, Transmission master plans and so on – documents containing proposals to improve policy and implementation in the Nepalese hydropower sector, and other sectors (WB Specialist). One example is the "Nepal Development Update: powering recovery", where the WB recommended comprehensive reforms to reduce the power crisis in Nepal during the load shedding period, by for example unbundling the public utility NEA (WB, 2016). Such documents are usually also followed by a promise of funding should the recommendations be implemented (WB Specialist).

4.1.2 Central technologies

This section presents the main energy generation technologies in Nepal, before moving over to describing how electricity is transmitted and distributed. Hydropower plants is the most central and well-established technology for energy generation in Nepal, as mentioned, and is usually connected to the main grid. Other sources used are non-electrical energy such as fuelwood, and technologies like solar power, micro-hydropower, and bio-gas plants. Jurisdiction of such other renewables have been transferred to provincial governments and is often connected to local or off-grid systems (Energy Advisor).

With the recent connection of Upper Tamakoshi Hydropower Ltd (UTHL), Nepal has a total installed electricity capacity of just above 2000 MW and peak demand around 1500 MW (Shrestha, 2021b). For comparison, in 2020 Norway – another hydropower-based country – had an installed electricity capacity of 37 732 MW, but only a sixth of the population size (EFN, 2021).

According to numbers from April 15th 2022, the current installed capacity of Nepal's hydropower plants (above 1 MW capacity) is 1975 MW, meaning almost all the electricity supply if they are producing at max capacity. This comes from 109 different projects (DOED, 2022b). Survey licences (projects above 1 MW capacity) have been issued to 191 projects, with 14468 MW total installed capacity (DOED, 2022e). Two of these planned projects are mega-projects with a total installed capacity of 1100 MW (DOED, 2022d).

There are three different types of hydropower plants and knowing the difference between these is relevant for understanding efforts by the private sector and grid balancing issues later in the analysis. A Run-of-River (RoR) project has little or no storage, meaning the river continuously flows, thus making production vary according to the water level fluctuation. Peaking Run-of-Rive (PRoR) means that the plant has storage capacity for normally 4-8

hours, and can then generate electricity during the peak hours of electricity consumption. Lastly, storage projects have a proper reservoir and can store water equivalent to its size, effectively turning the plant into a 'battery' for the dry season (IHA, 2022; NEA employee). There are differences between the three in terms of their environmental and social impacts, because the storage plants have dams that can leave large areas of land underwater (Brusa-Pasque, 2021).

Most of the projects in Nepal are of RoR-type. Other than that, one of the most recent, large plants to come online, UTHL, is of PRoR type. Nepal has no storage plants of considerable size. They have one 40 MW plant of this kind under construction and another 2-3 in the feasibility stage, but these will take many years to come online (NEA employee). There are established Power Purchasing Price's (PPA) for the different types of renewable technologies. NEA purchase electricity from developers according to these rates. For hydropower there is a wet-season rate and a dry-season rate. As most of the electricity supply in Nepal comes from RoR-plants, it becomes relevant to mention that PPA-rate is 4,8 NPR in the dry season and 8,4 NPR in the wet season (NEA employee; TKP, 2017).

Presence of other renewables is slowly growing in Nepal today. Four solar power plants with a total installed capacity of 20,18 MW are listed as developed. Another 30 projects of a total installed capacity of 1058 MW have been issued survey licences (DOED, 2022c). No wind or biomass plants are listed either as developed projects or survey licences, though the DOED might be excluding household-systems in their lists (DOED, 2022f).

Despite of Nepal's recent power surplus, the country is still importing more than 300 MW of electricity from India to cover their electricity demand in the dry season (Republica, 2022). This is partly due to the great variation in water discharge between the wet and dry season, meaning the domestic electricity production faces large seasonal variation. This situation could have been improved with for example more storage hydropower. The imported electricity is mainly generated from coal power (Energy Advisor; IPPAN member).

4.1.2.1 Non-renewable energy sources

The residential sector in Nepal, which consumes 80 % of the country's energy, still mostly covers their energy demand through traditional fuels (ADB, 2017; AEPC officer). However, the use of natural gas (LPG) for cooking has increased massively the last 5-6 years, as it is a more effective energy source and easier to transport (IPPAN member). Statistics from Nepal

Oil Corporation also shows a large increase in imports of LPG and oil since 2011 (NOC, 2022).

4.1.2.2 The electricity grid in Nepal and transmission of electricity between regions

Nepal's mountainous topography makes it technically challenging and thus expensive to expand the national grid, and for some parts of the country off-grid systems have been built instead (AEPC officer).

Nepal is in a process of upgrading their transmission system, which due to low transformer and grid capacity is needed both for the connection of new hydropower plants as well as for increasing consumption (Climate Advisor). A common issue with construction of transmission lines in Nepal is that they are expensive, with one challenge being connecting grids with different voltage (Statkraft employee). Most of the transmission lines today are of low voltage, but NEA are planning more and currently constructing one high-voltage line, which "will be the backbone of Nepal's electricity grid" when all power plants are connected to it (Energy Advisor). For the last 8-10 years, the state energy utility NEA has been studying how to increase the electricity interconnection with India through increasing connection points from one to six high-voltage lines. These will have the possibility of both exporting and importing and transmit more than 8-10,000 MW (NEA employee). A common issue with such projects is delays, coming from social issues around the construction of the lines. Sometimes this leads to a doubling in construction time, e.g., two to four years. Two other reasons mentioned for delays were the major earthquake in 2015, and due to the Covid-19 pandemic (Informant from NEA).

4.1.3 Main actors in the energy system and how they interrelate

The actors in a socio-technical system include everyone involved in the system, from producers, consumers, scientists, state institutions, organisations, businesses, or societal groups. Some of these form networks (Byrne et al., 2020). There is a range of actors involved in the Nepalese system. Within the state there are at least eleven involved agencies as well as the elected government. There are many private sector actors, financing institutions and organisations.

4.1.3.1 State agencies

First, I will go through the key governmental agencies involved in the electricity sector in Nepal. The Ministry of Energy, Water Resources and Irrigation (MOEWRI) is responsible for the overall planning of electricity and energy in Nepal. They are the focal ministry for policymaking within energy, and responsible for turning the goals into viable plans (Informant 3, 12, 14).

Below MOEWRI there are 3 departments and eight organisations. The most important one when it comes to electricity is Nepal Electricity Authority (NEA) (MOEWRI, 2022). This is the key agency when it comes to anything energy related in Nepal, and described as the agency who "controls the game", and as "very powerful (…) and one of the most important internal actors" (Nepalese consultant; Norwegian consultant). Thus, it seems NEA has large decision-making power. This could be explained by the board of NEA being controlled by the government, according to the Nepalese consultant. The managing director of NEA, currently Kulman Ghising, is not politically appointed, but elected for periods of 4 years (NEA employee).

NEA is a publicly owned utility company with branches across Nepal. They own and take charge of all stages in the energy production process. For example, NEA is both the buyer of electricity – from all plants, including the ones NEA owns – and the retailer of the power. They are responsible for the national grid, meaning on-grid transmission and distribution. They are involved in a big portion of the hydropower generation in the country. They are responsible for executing all Power Purchase Agreements (PPA) with private sector developers of all sizes of power plants. PPAs are formal agreement for how long and at what price NEA will buy power from the plant. If a project gains a licence to develop, NEA must give them a PPA (Informants 1, 3, 4, 11, 12). NEA is the main shareholder of the recently connected Upper Tamakoshi hydropower plant (UTKHPL, 2022).

Department of Electricity Development (DOED) is another department under MOEWRI. DOED is responsible for issuing all licences for hydropower projects of every size, as well as keeping records of all the projects that have applied for licences, are under construction, or in operation (DOED, 2022a; Informant 13).

The Electricity Regulatory Commission (ERC) was created with the purpose of placing the responsibility of power regulation and setting tariffs over to an independent body. Until two years ago this was done by NEA, which as a public utility also involved in power generation, they were in effect self-regulating. ERC oversees regulation of the whole sector,

from power generation, transmission, distribution, consumption to trade, both for on- and off-grid. They are mandated to set the electricity tariff, meaning deciding the price NEA can charge the energy consumers. So, when NEA presents their cost analyses the regulatory board will issue a tariff order accordingly (ERC-informant; Energy Advisor). Another important function of ERC is to "protect the rights and the interests of the consumers", according to the Electricity Act and Regulatory Commission Act. ERC is also responsible for studying how climate risk may be incorporated into feasibility, construction and operation of power projects, in collaboration with development partners (ERC-informant).

The Water and Energy Commission Secretariat (WECS) is also placed under MOEWRI. Their primary responsibility is to assist the government and the different ministries related to water resources in formulating policies and planning projects. As energy development in Nepal mainly means hydropower, they are often involved in policy formulation. For example, WECS are currently working on preparing a river basin master plan along with World Bank, and from that plan they will prepare a hydropower development master plan to "identify which are the most economically attractive candidate hydropower projects in different river basins" (WB Specialist).

Projects below 200 MW installed capacity fall under MOEWRI together with DOED and NEA. The planning of a power plant starts with MOEWRI and WECS making plans and regulations for energy development (IPPAN member). Then a private sector company (often called "a developer") may apply for a survey licence from DOED. Once a project gains a licence "they have to work with the local government, [and] the provincial government in fulfilling all the obligations of the licence" (Energy Advisor). The developers must then conduct all relevant socioeconomic and environmental impact studies, which in turn must be approved by the Ministry of Environment (Energy Advisor). After having obtained a licence, the developers will get a PPA from NEA, who must buy the energy (IPPAN member). ERC sets the tariff rate for the consumers (Informant 12).

Another state agency with importance for electricity development is Investment Board Nepal (IBN). It is a government authority created in 2011 to attract investments by mobilising independent power producers (IPPs) and foreign private investments towards large-scale energy projects (IBN, 2022; IBN consultant). They are also in charge of implementing projects with a cost above 600 billion Nepalese rupees (NRP) or above 200 MW installed capacity. Projects smaller than that fall under MOEWRI. By placing all such large-scale projects under one agency IBN hopes to streamline projects by reducing the time

spent on processing. This to make it easier for the developers undertaking mega projects. IBN has no authority over PPAs, electricity tariffs or environmental and social impact assessments (IBN consultant), but seems to be an important actor because of their role in attracting financing.

4.1.3.2 The elected government

Since Nepal started democratisation in 1991, the elected government has decided the specific energy strategies of the country. Though all the relevant ministries and departments in Nepal are involved in strategy and implementation for energy development and might invite stakeholders to contribute to forming the strategies, it is the elected government who sets the targets and decides the quotas for licences from DOED and the PPAs NEA can execute (NEA employee). For example, it was K.P. Oli's government that proposed the 2018 white paper (Nepalese consultant). The government also appoint ministers and may change the bureaucracy at their will. According to the NEA employee it is also the government's responsibility to come to an agreement with India regarding power exchange.

4.1.3.3 Actors involved in decentralised, small-scale, and off-grid electricity generation

Different actors are responsible for on-grid/central and off-grid/decentralised grids in Nepal. While NEA has the main responsibility for the central grid and is continuously expanding this, the Alternative Energy Promotion Centre (AEPC) is the focal point for off-grid energy development and renewable energy technologies that are *not* hydropower, for example solar PV, wind power, biogas. In Nepal these are called *alternative energy* (AEPC officer).

AEPC is a government institution working for mainstreaming alternative renewable energy resources among the population (AEPC, 2022). AEPC was established in 1996 and placed under the Ministry of Science and Technology (Informant 6). Their work was focused on providing basic energy services to areas difficult to reach with the central grid through solar power for households. "This we did with the support of Norway, Denmark and other European and development partners" (AEPC officer). Today they also do capacity building to decentralise some of the responsibility over to the local or provincial level. They do not develop the projects themselves but conduct procurements processes. Lastly, AEPC is the responsible agency for increasing electricity consumption, which they do by replacing cooking energy from traditional fuels to technologies that use electricity and by cooperating

with local governments. They are also an advisory body to MOEWRI (AEPC informant and ERC Commissioner).

In socio-technical system terminology one could say that there is a sub-system in the Nepalese electricity system that works with "alternative" renewable energy technologies and off-grid systems, where AEPC is key.

4.1.3.4 Other state agencies

In addition to the agencies mentioned above who are all directly involved in national energy issues, there are other governmental bodies involved in more indirect ways. The first one is Nepal Planning Commission (NPC). NPC is the most important advisory body for the government, in terms of formulating the national vision, development policies, and creating periodic plans and sectoral policies for overall development of the nation (NPC, 2022). NPC is also the focal point for Nepal's activities related to the Sustainable Development Goals (SDGs) (Informant 1).

The second is The Ministry of Finance, which is involved in several important ways, such as support NEA when electricity import has created liquidity problems (Republica, 2016). Another way is to work as advisor alongside IBN to the national bank, Rastra Bank, in creating a hazing mechanism to hedge against currency fluctuations. This is an important topic for large hydropower plants with external financing that will be revisited later (IBN consultant).

The third is the Ministry of Environment. They are responsible for Nepal's participation in for example the Conference of the Parties of the United Nations, and Nepal's international commitments such as the defining the NDCs, where for example AEPC, NEA and MOEWRI also have been involved (AEPC officer). Before a hydropower plant can be built, they need to get their environmental impact assessments and other obligations approved by the Ministry of Environment (Energy Advisor).

4.1.3.5 Private sector actors

An important actor representing private sector companies is the Independent Power Producer Association (IPPAN). It is a non-profit organisation of around 200 Nepalese investors who collectively lobby for private sector issues with the government. IPPAN was initiated in the early 2000s by two of the people involved in the first two privately developed

hydropower projects, and created together with 8-10 other foreign and domestic private investors (Informant 10). One of the first issues IPPAN were involved in was to create a grid code for how private projects were to dispatch their energy to NEA (IPPAN member). Today IPPAN has a strong voice and are involved for example in maintaining the existing PPA-system of take or pay (Informant 6).

There is a range of smaller or larger private power companies, both Nepalese and foreign, present in Nepal, and they are too many to mention here. The following companies are important because they are involved in hydropower projects that will be mentioned later in the chapter: Himal Power Limited, the first company that developed the first privately financed energy project in Nepal – majority owned by Norwegian Statkraft, BKK and a Nepalese developer Butwal Power Company (Statkraft employee). SAPDC – a joint venture between the government of India and Himachal Pradesh. TBI Holdings - a Nepalese private firm in partnership with Shanghai Investigation and Design Institute, and Yunnan Provincial Investment Group. Some others – both investors, developers and equipment suppliers – that were mentioned by informants were Sino Hydro (Chinese), Three Gorges (Chinese), Andritz Hydro (Austrian), CMC (Italian), Doosan (South Korean). There are also many Chinese and Indian development companies (Norwegian consultant). The foreign companies involved in implementation and long-term operation of energy generation projects (power plants) in Nepal can be seen as important parts of the energy system in Nepal.

4.1.3.6 International financing institutions and organisations

Several International Finance Institutions (IFIs) or multilateral development banks are crucial actors in the system. The three main ones are the World Bank (WB), the Asian Development Bank (ADB) and the International Finance Corporation (IFC) (Informant 1). What role they play will be elaborated in Part 2, but as the Nepalese consultant pointed out "They have big influence, because usually they are the ones with resources".

Several Embassies are involved in energy development in a variety of ways, such as the Norwegian Embassy and the British Embassy. From Norway the aid used to come through The Norwegian Agency for Development Cooperation, NORAD. The embassies currently provide aid in the areas of capacity building and transmission systems, or as support to AEPC (Informants 14, 5, 4, 9).

Other institutions or aid partners that have been mentioned are the Millennium Challenge Corporation(MCC) and their Nepal Compact, which is an agreement between USA and Nepal of grant aid within infrastructure and transmission worth 500 million USD (Informant 1). The Green Climate Fund is another actor involved in a variety of energy-related projects in Nepal. For example, they have given a 50 million USD grant to AEPC within clean cooking (AEPC officer).

There are also many different international non-governmental organisations (NGOs) present in Nepal. WWF, for example, have been advocating for "cumulative impact assessments" (CIAs), that look at the total environmental impact of multiple hydropower projects. They have also been supporting local communities in Nepal by aiding the development of several thousand small biogas plants and other off-grid systems such as solar home systems, as well as transitioning the end-use of energy in villages to electric cooking (Climate Advisor).

The South Asian Association for Regional Cooperation (SAARC) has been working for cooperation and economic growth in the region since 1985, and consists of Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka (SAARC, 2020a). Energy has been a priority area for SAARC since early 2000. The work is led by the Ministers of Energy from the member states, alongside various working groups. Their focus is currently to create an Energy Ring for cross-border trade of electricity in the entire region. A framework of electricity trade was signed a few years ago and is under ratification now (SAARC Divisional Director).

All these actors can be considered part of the energy system of Nepal, but one could also divide it into two systems that interact. Firstly, the mainstream, dominant system where actors such as NEA have a shared understanding of the rules and conventions connected to large-scale hydropower development, can be considered as a socio-technical regime. AEPC must be considered a part of the mainstream system, as a state agency that helps the state achieve its goals of energy supply and increasing demand. AEPC may also be considered as an actor that facilitates emerging technologies, such as solar power. And as we shall see below, AEPC also advocates for these technologies to become an established part of the system through policy and law, and thus change the 'rules' of the system. It is thereby possible to say that AEPC and related actors (such as WWF) are promoting socio-technical change in Nepal, and that the change can be seen as a type of emerging transition, where small-scale renewables such as solar power grows as a socio-technical "niche". Although, it is unlikely to take over.

4.1.4 System directionality

In socio-technical theory, system directionality usually refers to the trajectory of technologies, including visions for future technology pathways (Byrne et al., 2020). This will be addressed first. Second, I have decided to also include the more economic and political direction the system has taken.

4.1.4.1 The proportion of solar electricity is increasing

Historically, there has been relatively little solar electricity generation in Nepal. Informant 5 explained that during engineering school in 1995 solar power was discusses as a potential source of electricity, but as it was not cost-effective "nobody considered that as an option". Another (personal) perspective came from the AEPC officer, that solar power was not considered mainly because the thinking among stakeholders and politicians at the time was entirely dominated by hydropower.

Since then, the use of solar technology for electricity generation in Nepal has slowly gained traction, and the use of other renewables like biogas and micro-hydro has increased. The informant from AEPC said that there over the last 10-15 years also has been a widening of ministry-level thinking away from just hydropower and over to a realisation that an energy mix and energy security is needed. "Still their thinking is dominated [by] hydroelectricity, but there are some concerns and their understandings get better day by day" (AEPC officer).

There were hardly any policies for solar power until K.P. Oli became the prime minister in 2017. Until then "electricity meant hydroelectricity only in Nepal. Our previous legal documents were designed for hydropower generation only", explained the Nepalese consultant. Furthermore, Oli "always wanted to think out of the box. I think someone tried to convince him that we can do wind and solar, so he made a policy decision which was first of its kind in Nepal". This decision became a part of the 2018 white paper, which established an opening for renewables like solar (Nepalese consultant). The 5-10 % quota established for "alternative renewable energy" sources means that NEA now must buy this electricity (Informants 1, 3, 4b, 12, 16). The policy also established subsidies to reduce the cost of transmission and distribution of the technologies, and incentives through credits and royalty discounts from the government. There is also no import tax on solar PVs. AEPC was both involved in making the quota and will be involved in reaching it through providing support to the private sector developers (Informant 12). Many organisations, like WWF, are also working on small-scale renewable energy systems (Climate Advisor).

The prices for solar power have gone down drastically over the past 10 years and are starting to come down to the dry-season prices of Nepalese hydropower. As the price drops, investments are increasing accordingly (informants 1 and 6). The Climate Advisor explained that while economies of scale will help the solar price come down further, hydropower is not likely to become cheaper as it is time-consuming to build and because they are dependent on cement and steel, which might become more expensive.

Despite of the price drop, there are still two important constraints to further solar power development in Nepal. First, Nepal is already seeing land use pressure for farming (Informant 5 and 6). The second challenge is, as mentioned, the ability to regulate the national grid, as the power supply is already based on an intermittent electricity source – RoR-hydropower. Adding solar power or other renewables without storage capacity will add on to this issue (Informant 6).

4.1.4.2 Privatisation and unbundling of the power sector

Another important characteristic of the Nepalese power sector is that it has moved from being completely directed by the state, to a sector that is highly open to private sector investments and is pushing to attract more. Understanding this change requires a look back to the 1990s, to the initiation of a specific hydropower project with Norwegian involvement.

In the early 1990s, Nepal reinstated a multiparty democracy, and the elected government wanted to modernise the country by promoting a hydropower-led development, and end the domestic energy deficit. At the time only 8 % of the country had access to electricity. The government approached the small hydropower company Butwal Power Company (BPC), created by Norwegian aid-worker Odd Hoftun, to build a power plant on the Khimti river. As the project would be too large for BPC alone, they approached the Norwegian aid agency NORAD for support (Movik & Allouche, 2020; Norad Advisor).

Liberalisation of Norway's power sector meant hydropower was seen more as a commodity, and accordingly the Khimti project could not be developed by grant aid, but required private financing. Statkraft was thus included to develop the project (Movik & Allouche, 2020; Norad Advisor; Statkraft employee). As Nepal's legal framework at the time did not allow foreign or private investors to develop, the legislation was changed to allow private investment (Norad Advisor). The framework was also a precondition from Statkraft, who brought in "hard-nosed corporate lawyers" to the negotiations, that NEA could not stand up

against (Movik & Allouche, 2020, p. 5). The informant from Statkraft said something along the same lines.

The result was the promulgation of the Nepal Electricity Act in 1992. This mimicked Norwegian energy regulatory reforms, such that both foreign and private developers could invest in power development in Nepal (Movik & Allouche, 2020; Norad Advisor). According to the Nepalese consultant the new regulations were "very much drafted towards hydropower only, because at that time we only had hydropower as a source of electricity".

Himal Power Limited (HPL) was created to construct Khimti I. The company had Statkraft and BKK as main shareholders, and with Nepalese BPC with a share of mere 15 %, which "says something about how difficult it was to raise funds for this in Nepal" (Norad Advisor). The project was commercial, but did receive aid from The Norwegian Embassy and Norad, for example with rural electrification, as well as guaranteeing the Norwegian export credits (Movik & Allouche, 2020; Statkraft employee).

Another aspect of private sector-led projects that have been continued after Khimti I is the build-own-operate-transfer (BOOT) model, where the investors initially have full control over the project, and after 40 years it is transferred completely to the government (Statkraft employee). The Norad Advisor meant BOOT-agreements can be a solution to the lack of domestic financial resources, by letting private investors take care of the large investments. HPL got a very beneficial power-purchase agreement (PPA), something that has received much criticism over greed from both Nepal and NGOs. The Statkraft employee defended this PPA by saying investing in Nepal at the time was highly risky. And he thought Khimti "ploughed the road", as many investors saw there were profit to be made in hydropower after.

Consequently, Khimti marked an important shift in the state's attitude towards electricity development by opening for private sector actors with a privatisation-friendly legislation. The Government then started pushing privatisation on their own accord, and today there are many Nepalese investors in the electricity sector (Movik & Allouche, 2020; Norad Advisor).

Further privatisation of the industry has taken place after the 2000s, such as from the Hydropower Development Policy in 2001, where "They at least on paper [tried] to facilitate so that it would be easy for private actors to go in and invest in that sector" (Norwegian consultant). Ten years ago, the government and NEA also decided they would no longer go

into generation projects but let this be done by private parties and happen according to market principles (NEA employee).

For the last 10 years, a process of deregulation has also been ongoing, with the split of NEA into separate companies or agencies (unbundling) having been discussed for many years. The establishment of ERC, which separated regulation from power sale and purchase, was by several informants seen as a first step in this process. However, several also questioned the real authority of ERC compared to NEA (Informant 4, 6, 14). A new Electricity Act that would continue the unbundling of NEA into distinct generation and transmission companies was proposed several years ago but has yet to be tabled. The Counsellor and an Energy Advisor considered the regulations in this Act as part of the direction the Nepalese energy system is taking in the future. The Act might accordingly also open for private sector power exchange, whereas NEA today is the sole buyer and seller.

Today Nepal has liberal policies when it comes to private sector participation in the power sector, with the result that hydropower projects tend to be developed by private developers. Despite of this, the IPPAN member thought the conditions for the private sector are still not very favourable compared to NEA.

4.1.5 Summary part 1

To summarise the mapping of the Nepalese energy system, it is firstly clear that the consensus among actors of developing large-scale hydropower remains today, and was even increased by the promulgation of the 2018 white paper. In socio-technical terms one may say their path-dependency continues. This is partly supported by the policy environment, which involves documents from different political levels. However, the system is moving slowly in two important directions, the first being an opening for an emerging system of other renewable energy technologies. With the involvement of e.g., AEPC and WWF this can be seen as an emerging system or niche. However, making clear distinctions between regime and niche in the case of Nepal is difficult, as state agencies like AEPC may also be considered part of the mainstream socio-technical system or regime. It is also evident that international actors like Statkraft or the World Bank are in relationality to state actors and processes in the system and have influence as seen from the polices. The second direction is an ongoing liberalisation of the energy sector, which is influenced by actors on other political levels, such as Norway. This has consequences for the state agencies like NEA, which is a powerful and key actor within the system or regime. In sum, one may say the Nepalese system is not static, but slowly changing both technologically and institutionally.

4.2 Part 2: Factors that influence progress of electricity generation in Nepal

In part two of the empirical analysis, I will analyse how four different contextual factors influence progress in the Nepalese electricity generation system. I will build on part one by looking at how these contextual factors relate to actors, strategies, technologies, and other components of the system. While some of the factors here are closely connected to the system itself, or may be seen as part of the system, others may be seen as outside the system. I will start with financing, and look at public financing in Nepal, private sector financing, and onwards to financing from international actors like finance institutions, bilateral aid partners and foreign direct investments. The second factor I will look at is geopolitics, and how Nepal's relationship to India, the relationship between India and China, Chinese and Indian investments, and third-party actors influence the progress of Nepal's strategy. Then I will look at how climate change issues have played a role for strategy implementation or progress, starting with the influence from international climate politics, followed by the role of natural disasters and climate risk, access to climate funding, and lastly Indian climate commitments. Lastly, I will look into national factors, such as how the political narrative, national politics and corruption and local contestation have shaped progress.

4.2.1 The role of different sources of financing for electricity generation

Different modes of financing have shaped both the electricity strategy itself, and the way implementation in terms of hydropower construction has taken place. In this section, I will go through five different sources that are either important today or historically.

4.2.1.1 Financing by the public sector in Nepal

Nepal itself does not have enough financing capacity for massively increasing electricity supply like the 2018 white paper suggests. If we compare the cost of a large Nepalese power project with their state budget, it would be evident that the projects would happen at the expense of other sectors such as education and health, if they were to be financed by the state. This was pointed out by both the Norad Advisor and the Climate Advisor. The Climate Advisor further highlighted the issue of financing in relation to export to India – "The

politics are still there, but those are its ambitions (…), written in the long-term strategy. But again, as I said, the problem is financing, and which source of financing will come into the country".

Hydropower development has relied on foreign financing from the start, and this is assumed to continue in the current strategy from 2018. Without it, the plans would have been much more limited. The Statkraft employee considered it theoretically possible for Nepal to develop several thousand additional megawatts by 2028 if one considers the licenses for hydropower projects currently distributed. However, the billions needed to develop those licensed projects "they don't exist in Nepal. (…) So then international actors must come in with loans and financing". He thought the Asian Development Bank (ADB) and the World Bank (WB) could contribute with some, but otherwise "financial or more commercial sources of financing must come in to finance 5000 MW". As mentioned, the white paper itself points to private sector participation for achieving the hydropower development targets.

4.2.1.2 Private sector financing from within Nepal

When it comes to the Nepalese private sector, it is hard to distinguish between the domestic sources of funding and the private sector actors involved in project development. I will therefore look at the role of both in this section, and I will use the Upper Tamakoshi hydropower plants as an example throughout.

Challenging investment climate

The comments above points to foreign funding as necessary to develop the hydropower projects needed to reach the current targets. The question is, why is the domestic private sector not able to develop the projects, considering the long-standing privatisation policies? Several informants attributed this the country coming out of a challenging investment climate. After the Maoist insurgency ended in 2006, and until around 2013-14, Nepal was going through a "normalisation period", where they did not know if a new conflict would arise. The country was in a dilemma as the electricity consumption was increasing, but little was invested in new production, and therefore the electricity supply could not keep up (Norad Advisor). As mentioned in the introduction, the state load shedding started in this period. The Norad Advisor explained that during the normalisation period "the government was weak, there were large internal opposition, at least rhetorically. Some [political parties]

said they wanted private investments and others didn't". All the uncertainty created a bad investment climate, meaning that despite of the long period of privatisation policies, private investors were not developing hydropower projects according to the strategy (Statkraft employee). In this period, it is therefore reasonable to conclude that the private sector contributed little to the progress.

Private sector investments the last 10 years

Since then, a lot has happened in the electricity sector, such as the end of the official load shedding and the country reaching a seasonal power surplus. However, there seemed to be diverging opinions from informants as to the role of the domestic private sector in reaching generation surplus the last 10 years. One perspective came from the NEA employee, who said that around 10 years ago a lot of licences to develop hydropower plants were distributed from the state to the private sector, but the private sector was not able to develop enough plants for internal demand. The informant had several thoughts as to why this might be. The first was access to capital. He thought the financial sector in Nepal was not "ready" to give loans to the private sector at the time, meaning there was not enough capital to fund the hydropower projects. The second was that the Nepalese developers were not yet "ready" to develop, as they were inexperienced with hydropower projects. Furthermore, "maybe there were not enough construction companies in Nepal, not enough consultants in Nepal. Because you cannot just hire foreign guys – it will make the cost higher also" (NEA employee).

A third reason for why the private sector did not develop their licences, could according to the NEA employee be due to license-trading. This issue was pointed out as well by other informants , and concerns a 'boom' of licences having been handed out 10 years ago, and how it led to delays in hydropower construction. Because the licenses were cheap, many private investors would get a PPA done, or just enough to document to MOEWRI that they were legit investors. But then they would try to sell their license for a profit, rather than construct the plant (Informant 6 and 16). The consequence was according to the NEA employee that the cost of hydropower projects increased, and that the projects were not developed in the planned time. The trading thus led to delays in project completion.

While the NEA employee mainly pointed to issues within the private sector as the reason why implementation had gone slow, the informant from IPPAN had a different perspective. He thought there had not been enough encouragement towards the private sector to participate in reaching the state goals, and that the support was still not sufficient.

A third perspective came from the Statkraft employee, who considered the progress in the energy sector the last 10 years a result of private sector efforts. The number of Nepalese private sector investors has risen dramatically. The Statkraft employee thought it could be attributed to Nepal having had a positive economic development in general, or that the country was more optimistic of the future after the internal conflicts started to settle and the constitution was finalised in 2015. He thought it may also have had to do with Nepalese actors seeing the profitability of the Khimti-project.

There might thus be many explanations as to why hydropower development has been going slowly in Nepal previously, but it seems the domestic private sector today is heavily involved in the progress of the sector. According to the Norad Advisor, the high number of Nepalese private sector actors today is due to the Electricity Act of 1992, in that it opened for Nepalese investors in the power sector - "In that regard it was highly successful". For example, IPPAN has grown massively, and many hydropower projects are being constructed (Informants 6 and 10). Today, around 90 % of the current 300 projects with a licence are held by small private Nepalese investors. And of the existing hydropower plants in Nepal, approximately 50 % is owned by the state and the rest by private independent power producers (IPPs) (IHA, 2019). Most of these plants are of the medium size, between 20-100 MW, and of the run-of-river type. Several informants also commented that the private sector is much more experienced in development of small and medium sized hydropower today (Informant 5, 6, 16). One of them was the informant from NEA, who agreed that the private sector today "is both investing and constructing a lot".

The cost of large-scale projects

It seems clear that the private sector's participation in hydropower has increased greatly, but as mentioned in the system mapping, what the country now needs is storage hydropower to improve the grid-balance between seasons. Licenses for storage projects have also been offered to the private sector, but the investors have not come forward to develop it (NEA employee).

An import reason for this relates to the cost of the projects. Storage projects tend to be of larges size, such as 4-500 MW plants, and Nepalese IPPs cannot finance these projects on their own (NEA employee). According to a Norwegian consultant, it is relatively easy for Nepalese investors to get a loan for small- and medium-sized projects from Nepalese banks today, as the banks are eager to get into the hydropower sector. However, getting those loans require that the developer have a minimum of 15-20 % equity (Informant 6 and 16). For

smaller-scaled projects, Nepalese investors are often able to provide the equity through for example an "Initial public offering" (IPO) and collect money from the general population. They can also get it from citizen investment funds. But neither would provide enough equity for large-scale or storage projects. For that they would need foreign developers as strategy partners, such as joint ventures (IBN consultant and IPPAN member). The cost of the large projects could thus explain why Nepalese investors, despite the licenses having been open for many years, have yet to start developing projects of the largest scales.

The exception – Upper Tamakoshi

One exception is the large-scale Upper Tamakoshi hydropower plant (UTHL), which was finalised in the autumn 2021. A Norwegian consultancy did a feasibility study of the plant in 2004, and several models of financing were discussed thereafter. The informant involved in the project explained how at some point it was decided that "this will be a national project. We are going to pay it with our own money. We will manage to raise domestic capital". This has become a form of brand for the project, and they have taken pride in that they did not finance it with donor funds or foreign capital (Informant 6). The plant was developed as a publicly traded company, and the necessary funds were raised through an IPO. In fact, most of the Nepalese informants mentioned they held shares personally. Shares were also given to the locally affected (IPPAN member). After the IPO, NEA also held 51 % of the shares, financed through loans from the private capital markets (NEA employee). This cooperation between NEA and the private financing could be an example of public-private partnerships mentioned by Virtanen (2006), and could explain how they managed to finance UTHL. According to a Norad Advisor, UTHL would likely not have happened without Nepalese investors. Furthermore, the Nepalese consultant thought UTHL created a lot of in-house experts and improved project management skills for hydropower projects.

However, the completion of Upper Tamakoshi was delayed by 4-5 years, something that made the cost almost double in the end (Norwegian consultant). The Nepalese consultant therefore called UTHL a "loss-making project". A Statkraft employee accredited the delays to "a mix of extremely poor technical progress, bad contracts, and corruption. And then of course there was the earthquake, and they were hit very hard". If UTHL is an example to go by, this might explain why the equity requirement for large projects are so high, and why the cost of large-scale projects is too high for Nepalese private investors alone. The NEA employee thought the high costs might be the reason why private investors tend to go for medium sized run-of-river projects today.

Private sector push to change the PPAs

Despite private sector financing not having the capital for large-scale projects, the actors involved evidently still play an important role. This is visible in negotiations between NEA and private sector actors regarding Power Purchase Agreement (PPA). Before a new power plant can be connected, power companies must enter a PPA with NEA, which has a monopoly on electricity purchase and sale. The most common form of PPA is a take-or-pay agreement, where NEA can choose to pay a minimum or take the power (Informants 6 and 16). The NEA employee explained that influence from the private sector today mainly relates to lobbying around two aspects of PPAs. The first is to increase the quota for Run-of-River projects, and the second to increase the rate in the PPAs, meaning what price they get from NEA when they sell them the electricity.

The first issue concerns the PPA-rate. The employee from NEA explained how IPPs have been complaining about the established PPA-rate for the past 10 years. Accordingly, they lobby towards the government to make them increase the rate - "And everybody knows, if the government pays, that will be borne as taxes by the people". He further explained that as the population of Nepal was poor, the majority would not be able to afford to buy electricity with higher prices. He considered this a good argument to keep control of power prices within the government and not deregulate.

The second issue relates to the 35 % quota for RoR-projects established in the 2018 white paper. As explained in the system mapping, to build a power plant a developer must get a survey licence from DOED, and when the survey is completed, they get a PPA with NEA. Both the NEA employee and IPPAN member pointed to issues with this system. Licences for more than 15,000 MW have already been given out just for RoR plants, and consequently the quota for PPAs have been reached. The result is that NEA has stopped giving out PPAs for RoR. The informant from NEA explained that private producers have been lobbying with the government to increase the quota for RoR, with the argument that they already hold the licences and therefore the RoR-quota should be extended. "They are not trying to expand the 15,000-limit, but they are trying to reshuffle the quotas. Like for RoR they are trying to increase from 35 to 40, even 50 % also. And try to minimise the quota of storage projects". This gives connotations to what Newell (2021, p. 152) writes about taking into account the power firms have to shape "state-based energy pathways" and its effects.

The informant from IPPAN on the other hand, gave a very different explanation as to why NEA had stopped handing out PPAs:

> *Last year in wet season we got surplus energy. So, the government sector thought 'we have enough power now, so why do we need more power?'. Therefore, they thought of not buying more energy from the private sector. Rather they will complete all the projects, and wait and see how energy demand will grow (IPPAN member).*

From the NEA employee's perspective, the reason for keeping a strict quota was that NEA risks bankruptcy if not. The electricity consumption in Nepal is not high enough to take all the electricity if all the current PPAs are fulfilled (i.e., if all the plants with a license are constructed). As these projects are of the RoR-kind, the dry-season generation can be consumed by Nepal, but the wet-season generation will give a surplus several thousand MW above the current consumption - "It is a huge amount! And in terms of money - billions of dollars" (NEA employee). NEA would effectively go bankrupt due to the lack of market for the wet-season surplus, a loss the government would have to bear. According to the NEA employee, "This issue has been discussed in Nepal for the past 10 years". The reason why they are still able to pay for the PPAs of plants in operation is that the private sector hydropower plants licensed years ago did not get commissioned yet (NEA employee). While RoR-projects technically could come up in 2-3 years, it usually takes 6-7 years due to the complexities around constructing hydropower. The delays to constriction of projects from the private sector is thus a benefit to NEA, as the PPAs does not have to be paid until the projects come online. "As they were getting delayed, the financial bad time of NEA was also getting delayed" (NEA employee).

This changed with the connection of UTHL and other projects starting to come online. As mentioned, with the Upper Tamakoshi hydropower plant being connected in 2021, Nepal for the first time experienced the long sought-after electricity surplus. The NEA employee therefore thought NEA in 2-3 years would be in a situation where they will have to pay for many new PPAs, but not be able to sell the power. "We have given that concern to the government – every government, every minister. Now they are the ones to facilitate power [sale], because NEA cannot do that. It is a political issue" (NEA employee).

However, UTHL is a peaking run-of-river project (PRoR). Despite of this being valuable in Nepal in terms of comparatively more power regulation capacity than for ROR-plants, the river flow makes seasonal variation of generation capacity large also for UTHL. While the

maximum installed capacity of the plant is 456 MW, the project only gives 95 MW in the dry season, explained a consultant for the project. Thus, Nepal must still cover their dry-season deficiency through importing electricity (NEA employee). Furthermore, the lack of market for UTHL's wet-season surplus, combined with the project's take-or-pay agreement with NEA, meant the company was not allowed to deliver all its power to the grid. As a result, UTHL had to spill a great deal of water in its first wet-season and be at a loss. The consultant involved in the project thought this displayed "an imbalance in the market", and that it might be discouraging for other private investors.

To summarise, the role of private sector financing has moved from contributing little to progress in the electricity sector, over to being an important part of the current developments. This shift is not just due to the actors using this source of financing, but also relates to processes and events within the state and state actors. The increased importance of domestic private sector actors seems to have given them the power to negotiate with NEA. This is not without consequences for NEA in terms of issues paying for the additional power without a market to sell it to. Furthermore, Upper Tamakoshi as an example of strategy implementation displays how private sector investments in large-scale projects can bring Nepal closer to their targets by creating power surplus. The project improved competencies and skills which will be useful for future projects. However, the project also displays the challenges Nepal faces in the move from power deficiency to surplus when using such variable electricity sources.

4.2.1.3 Financing from international finance institutions

This section will take look at how funding from international finance institutions works in Nepal today, and what role it plays for strategy implementation. The main institutions providing such funding today are the World Bank (WB) and the Asian Development Bank (ADB), as mentioned. The section will start with a look at the way they have provided their financing and on which conditions, historically.

Dependency on international finance institutions since the 70s

"Foreign aid has played a key role in Nepal", according to Movik and Allouche (2020, p. 5). Aid flows from international finance institutions (IFIs) have been present in Nepal since at least the 1970s, starting with World Bank supporting the financing of two medium-sized hydropower plants (WB representant). In the beginning of hydropower development in

Nepal the government would request funding from the WB, and the WB would give it directly to the government and develop the project, explained the NEA employee. From the mid-70s aid-dependency in Nepal increased from 34 % of the national budget to almost 70 % in the 90s. Today, aid still accounts for a large portion of the country's development expenditure (Movik & Allouche, 2020).

Financing for energy development depends on donor preferences

The access the state or private sector actors have to financing for energy projects depend on the donor and its preferences. For example, the informant from AEPC explained that when they work with partners such as WB, ADB, EU, USAID, UNDP, CDF, and foreign embassies like Germany, Norway and Denmark, the support they get and in what area depends on the donor. The main support comes in the forms of combinations of financial assistance, technical assistance, or capacity building (Informant 12). For example, ADB supported solar power in its early days in Nepal through subsidies, and today the WB is funding a 25 MW solar project in conjunction with NEA (NEA employee).

Another example is Arun III, which the WB was heavily involved in in 1995-6. This was one of the largest projects being planned at the time (Informant 10). As we shall see later, the WB pulled out of it entirely, and the project was 20 years later picked up by an Indian company. The NEA employee said that "what we unofficially heard [is] that from that time the WB was not interested in generation projects. They were interested in transmission projects, but not in generation projects". However, the WB is today again involved as financier in several hydropower projects again today. One of the projects they are planning to finance is called Upper Arun (1016 MW), for which the WB is currently doing a review of technical designs and feasibility studies (WB Specialist).

Another example of donor preferences is that while the state strategy is still mainly to increase energy supply, IFIs are today more concerned with expanding or improving transmission and distribution in Nepal. For example, providing loans for a new high-voltage transmission line that will cross the country. Several other lines are under planning with investments from donor agencies like the ADB and the WB (Informants 4, 10, 13, 16).

Considering the importance of a stable grid to transport the electricity Nepal is planning to add, it could be said that IFIs deciding to fund transmission and distribution ultimately contributes to reaching the Nepalese strategy of 15,000 MW by 2028. What seems clear however, is that IFIs and other donors decide themselves to what areas or projects they wish to provide aid. Those areas might not be coherent with the government strategy. Whether

that leads to progress or delays is hard to judge, but one may at least interpret that with Nepal being dependent on foreign funding for their large-scale projects, the ability of donors to decide what they finance has an influence on strategy implementation and progress.

The conditions for loans from the World Bank and the Asian Development Bank

Obtaining a loan from the WB involves strict terms and conditionalities, which many private investors have trouble fulfilling. WB's loan method has some proportion coming as grant, while the largest proportion comes as a loan (Climate Advisor). As mentioned, the ADB and the WB were the main loan-giver of Nepal's first private sector developed hydropower plant, Khimti I (60 MW), developed by a consortium of Norwegian and Nepalese companies between 1996-2000 (Statkraft employee).

The strict economic terms from the ADB and the WB almost made Statkraft pull out of Khimti entirely (Statkraft employee). Two times a year, the IFIs send accountants from top private consulting firms to do revisions. The developers get long checklists of things they have not fulfilled, and which they must fulfil to receive a project completion certificate, and take out dividends. "They are extreme on requirements. It is so bureaucratic" (Statkraft employee). For Khimti the banks also set as requirement that the developers transfer revenue to an American trust, which Statkraft could not access until they had received a project completion certificate. This took 3 years after they started operating the plant. The Statkraft employee therefor said "It's primarily a cheap way of financing, but it's a lot of work to document [everything]".

The IPPAN member told a similar story about the conditionalities. The main issue with such loans for Nepalese investors is that implementing them makes the cost of the project increase, and "we are not getting back those money in return from the government buying the energy". What he is referring to is the fixed price for electricity in Nepal, meaning that developers cannot try to get more for the power sale, despite of the cost increase for the project. Consequently, very few Nepalese developers go to these IFIs for loans (Informant 14).

Reviewing what the actual requirements of the IFIs to get a loan are in detail, is beyond the scope of this thesis. However, the informants pointed to mainly technical, environmental and social conditions (Informant 10 and 14). This seems in line with literature claiming that such international institutions are working with mainstreaming climate and environmental concerns in their lending programmes (Newell, 2014). Accordingly, there are way less

requirements from normal commercial banks, and thus Khimti remained one of the few projects Statkraft funded with loans from the WB and the ADB (Statkraft employee).

These informants' comments give connotations to what Newell and Phillips (2016) calls disciplinary neoliberalism, especially considering the large loans as seen with the examples of the Upper Arun project. Though the conditions mentioned by the informants are related to environmental and social requirements, more so than requirements for private sector involvement, the comments show that there are specific conditions for obtaining financial support from the WB also in Nepal.

The result of the strict conditionalities is thus that many private sector developers have moved away from WB loans, while the state still depends on them for large-scale projects. This can explain why NEA employee said regarding the ADB and the WB "I personally do think they are quite reliable donor agencies for us", while the private sector informants from Statkraft and IPPAN where more sceptical. Another explanation might come from the previous section on the private sector, which today normally get financing from Nepalese banks.

The World Bank influence Nepalese regulations

One of the main ways the IFIs like the WB is involved in Nepal's electricity sector comes through their "regulatory support" to the government and state agencies (WB Specialist). The most important support is in the form of master plans, as mentioned under policy environment, and support to the government in the making of acts and regulations. For example, the WB is working with WECS to prepare a river basin master plan and a hydropower development master plan "to identify which are the most economically attractive candidate hydropower projects in different river basins" (WB Specialist). After, they plan to work on a least-cost generation expansion plan with NEA. This is intended to meet future demand by identifying the most attractive hydropower plants, and other resources like wind, solar, and thermal power. The study identifies what the most economic expansion scenarios are for the next 15-20 years, and even energy import is considered as an alternative there (WB Specialist), quite contrary to the Nepalese strategy. The WB's purpose of making these different plans is arguably to help the government make policy decisions and reforms in areas such as hydropower development (WB Specialist).

The WB continuously comes with recommendations to the Nepalese state, which the state can choose to implement to gain an economic reward from the WB. This seems like a softer form of conditionalities, disconnected from the concrete loans for hydropower projects. The

informant from the WB explained that "we do not directly support the private sector, [but support] policies that encompasses the overall benefit for the country". The policy reforms are supported through a tool called Development Policy Credit, and two series of 100 million USD have been completed in Nepal so far. This support is accordingly based on WBs assessments, and not on the initiative of the Nepalese state. The work is also conducted by the WB international experts and by the WB Nepal's advisors with knowledge of the sector (WB Specialist).

> *We do an energy sector assessment, and we sometimes talk to the different agencies. (…) We talk to the government and try to assess where there are gaps, or where there's a need for those kinds of support. (…) We thought there is a huge gap in the planning. That's why we are helping to prepare the hydropower masterplan, transmission masterplan, least cost masterplan (WB Specialist).*

Based on the reports, the state will try to implement the recommendations, which could be regarding how the licensing should be awarded, or how they should develop different types of hydropower projects. The WB Specialist said that the government can choose to ignore the recommendations from WB, but they will be awarded for implementing a certain policy or regulation through the development policy credit scheme, which ranges between "100-200 million dollar, based on when they adapt certain policies". One example of such recommendations came from the IPPAN member. Regarding the mentioned unbundling of NEA, he explained that all the different IFIs have been pushing the government to segregate NEA into smaller entities. This is again similar to "disciplinary neoliberalism" and how it is used by IFIS to make developing states adopt policies in line with neoliberalist ideas, such as private market development and deregulation (Newell & Phillips, 2016).

Movik and Allouche (2020) also found that Nepal's vision of building the state through hydropower had been eroded over time, because donor-led efforts to liberalise has fractured the Nepalese energy sector. Though as evident from the system mapping, with the exception of the ERC, unbundling has not happened yet. According to the IPPAN member this is due to resistance from workers unions under NEA. NEA thus still holds a monopoly over power purchase and sale in Nepal. And regarding whether regulatory influence from IFIs have led to reduced public spending – another example of neoliberalist policies - the informant from AEPC actually pointed to the opposite. He explained that the portion of state support to AEPC today is larger compared to financial support from aid institutions than it was before.

Nevertheless, there is still "a lot of pressure from the investment organisations – WB, ADB, all the people are trying to push the government" (IPPAN member).

That IFIs have a big influence on strategy implementation in Nepal might be explained again by the fact that there is not enough capital within Nepal to fund all the hydropower projects and accompanying infrastructure to reach the state strategy. For example, the Nepalese consultant commented that IFIs like WB, IFC and ADB have a big influence because they have resources that Nepal needs.

> *They kind of direct the discourse of electricity in Nepal. Whether we want to be centralised, hundred per cent hydro, whether we want solar, because we don't have the capacity or resource to (…) construct everything on our own (Nepalese consultant).*

With the privatisation policies promoted by the state, it is clear that constructing everything nationally or publicly is not the government's plan. But, with Nepal lacking resources domestically they will be more directed by what the donors wish to fund, and they will have less room to decide this for themselves. The situation in Nepal appears as an example of how neoliberalist policies imposed by institutions like the WB limit the policy space in developing countries to pursue an independent energy pathway, as described in the literature (Newell, 2021).

Through the collected data it is not possible to claim that Nepal opened for privatisation because of the influence of IFIs. Rather, as mentioned, both one informant and Movik and Allouche (2020) pointed to the privatisation directionality coming from the Nepalese government, as well as with influence from Norwegian aid partners. Nevertheless, Nepal has followed the global timeline of increased privatisation in developing states, with a dominating presence of IFIs like the WB that remains today.

4.2.1.4 Bilateral aid funding

Bilateral aid has been an important part of Nepal's electricity development, as explained in the system directionality. It is still present today, but seems to have taken more of a backseat and is now less involved in hydropower projects directly. Bilateral aid is today more concerned with capacity building and financing transmission lines. Some major bilateral donors involved in the energy sector are The Norwegian Embassy, USAID, The British Embassy, and the EU (Climate Advisor). Norway was one of the bilateral aid partners most

often referred to during interviews, which might be because I am Norwegian and the informants therefore made the association, or because Norway has been present in the Nepalese hydropower sector since the development of the Khimti plant. Therefore, I will mostly assess the role of bilateral aid from Norway in this section.

The legacy of bilateral aid from Norway

The Norwegian involvement in the electricity sector in Nepal started with financial support to several small-scale hydropower plants through the 80s and 90s (Norad Advisor). Together with Norwegian university NTNU, Norwegian aid invested a lot of resources to develop an entire ecosystem for hydro projects, such as training Nepalese engineers in Norway and sending used hydro turbines to Nepal for training. One could say that they were trying to develop an emerging socio-technical system around hydropower (Geels, 2011). Furthermore, after the government liberalised the electricity market in 1996, all documents were drafted towards hydropower only. "We didn't have any other option. [For example] solar was not that much in the picture, because the technology was very, very expensive", said the Nepalese consultant. This, combined with the large hydropower potential in Nepal, "is why dependence on hydro became very high (Nepalese consultant).

However, Norway, as well as other donor countries like the USA, are today not interested in contributing to increasing electricity supply or financing power plants in Nepal (Norwegian consultant; Norad Advisor). Today such actors are more focused on contributing to sustaining the 'hydropower ecosystem' through enhancing local resources, skills, and solutions. This is done through technological research and development, smaller grants, and support to Kathmandu University (Nepalese consultant). Norwegian bilateral aid has also been involved in capacity building in a variety of ways, from working with democracy building and local democracy, to capacity building and financial support to IPPAN up to 2004 (Statkraft employee). The Nepalese consultant referred to Norway as "the ones with all the technical know-how", and said "since they are the pioneer or supporting agency in Nepal since the late 80s, I think they have this legacy".

Bilateral aid facilitating private investments through funding the transmission system

Bilateral aid partners, such as Norad and USAID, are today supporting projects related to the Nepalese transmission system. As for why they still give financial support to this area, and not to electricity generation projects, the Norwegian consultant explained that donors believe "there is definitely no point in putting money in [increasing] production capacity when there is no grid to distribute it with". The Norad Advisor similarly explained that

Norway still finances transmission lines because more people can use them, both for transmitting from the power plants, but also out to the users. Accordingly, financing of transmission lines "helps to trigger private investments". The informant from Norad was very positive to private investments in developing countries, and explained that this is how Norway works.

> *It is not realistic that this gift financed* (grant aid). *For example, in Africa many countries have high debt, and therefore loans from the large banks are not realistic either. Then you are left with private investments as the only realistic and least inappropriate, according to how you look at it (Norad Advisor).*

Similarly, The British Embassy is working on attracting foreign direct investments, as "private sector investments are not sufficient" to fund anything in Nepal larger than medium-sized plants (Informant 5). It might seem like bilateral aid partners such as Norway has a similar kind of thinking around how electricity development should be conducted in Nepal as the IFIs. One example of this thinking goes back to when Norad financed the feasibility studies of the Upper Tamakoshi hydropower plant in the early 2000s. They conducted a tendering amongst private consulting firms to do the study. The contract was won by Norwegian Norconsult, who has been involved in the project since then (DT, 2004; Informant 6). Another example is how the British, Norwegian and Danish embassies are supporting Nepal Renewable Energy Programme, which is meant for private sector investment to both decentralised and grid-connected electricity projects (Informants 6 and 12).

It could seem like Norway and other bilateral aid partners have been important not just in building a socio-technical system of hydropower in Nepal, but also in maintaining it. In one way the bilateral aid partners are not contributing to progress, as they are not financing hydropower projects directly. Their financial support is after all determined based on donor preferences and not mainly by the Nepalese actors. On the other hand, as the system mapping pointed out, transmission and distribution are a challenge both domestically and for future export of electricity, and thus financing from bilateral aid might be seen as leading to progress.

4.2.1.5 The role of FDI for electricity generation projects in Nepal

Since the 1990s a process of privatisation has been ongoing in Nepal, and today private sector investments in hydropower generation is encouraged and desired. As described under system directionality, this started with the promulgation of the Nepal Electricity Act and the development of the Khimti I hydropower plant, financed by Norwegian FDI. The Act not only opened for domestic private investments, but also for foreign direct investments (FDI). This section will look at what some consider the main implication of FDI in Nepal today, being depletion of Nepal's foreign currency reserves. I will also touch upon FDI again in later sections.

This issue of foreign currency depletion has two sides. On the one hand, Nepal and other developing countries have a weak currency that is being devalued. The Nepalese rupee is attached to the Indian rupee, and has been decreasing in value the last 25 years (Norad Advisor). Nepal also struggles with low foreign currency reserves, with USD being the most important. This is because they are a net importer of much more than just energy. The biggest source of foreign currency in Nepal comes from migrant labourers sending remittances back to Nepal. While significant, this is not enough to balance out the drainage to the reserves from all the imports. Therefore, the Nepalese consultant explained that Nepal is very tight with their USD – "that means if somebody invests in Nepal we will rather want to pay them in rupees, and they rather want US dollars. So that is the greatest roadblock".

On the other hand, you have foreign investors involved in Nepalese hydropower plants who have taken a loan in dollars. They therefore demand that PPAs be in US dollars or a convertible currency, so they can finance their loans (Nepalese consultant; Counsellor). The Counsellor explained how that demand causes a lot of challenges for NEA, especially if they sell to domestic consumers, because "it will be a drain on the resources on behalf of NEA".

As the Nepalese rupee is depreciating it becomes increasingly hard for NEA to pay for PPAs in dollars. The alternative to NEA paying in dollars as the foreign investors request "is that Nepal would have been in an electricity deficiency [situation]", according to the Norad Advisor. And in that case people in Nepal accordingly start using diesel generators. Nepalese diesel is imported from India and cost more than double the price per kilowatt hour than what Nepal would pay a foreign investor for electricity from a Nepalese hydropower plant. This was the case when Nepal was in the load shedding period, and the dollar reserves of the country was as a result severely drained (Norad Advisor). With such low USD reserves Nepal becomes vulnerable to global fluctuations, and paying foreign investors for

electricity can thus suddenly become more expensive (IPPAN member). This gives connotations to Hancock & Sovacool's (2018) theories on price fluctuations for electricity systems dominated by hydropower.

The situation could be improved if the additional electricity could be sold to for example India or Bangladesh, as they would pay in USD. In other cases, where plants are developed as joint ventures between Nepal and a neighbour country which will import the power directly, such as for the Arun III-project, a significant part of the electricity is typically given for free to NEA. This in turn would increase NEA's potential source of revenue by selling the free portion to domestic consumers and avoid any foreign currency (The Counsellor).

Another solution could be that hydropower projects were only financed by Nepalese developers. The benefit would be that domestic investors want to be paid in local currencies, which avoids the issue of foreign investors requesting dollars (Norad Advisor). However, with foreign currency reserves already being low, additional PPAs today, be they foreign or domestically funded, would just add on to NEAs existing problem with paying for power. For example, after UTHL came online and gave Nepal a power surplus in the wet-season, NEA's issues with upholding existing PPAs have been increased, despite UTHL being nationally financed (ERC Commissioner).

This points to a need of updating regulations in terms of currencies and payments of PPAs. According to the Climate Advisor "foreign companies will not invest until it is ensured that they will get the returns" in USD. The Statkraft employee pointed out such an issue when trying to get an updated PPA for Khimti I with the government, related to their BOOT-agreement. With it being "next to impossible" to negotiate with NEA on new terms for the PPA, Statkraft is now in the process of withdrawing from Nepal (Statkraft employee).

There is apparently an ongoing discussion in the government on whether to make a wholesome policy for how much a foreign investor can receive in USD, or whether to decide on a project-basis. "That will be important for the government to decide", according to the IPPAN member. He further said work is being done on making a 'hazing mechanism' to hedge against the currency fluctuations. This will decrease the risk of the increased value of USD compared to Nepalese rupees. The work has been led by The Ministry of Finance for the last two years, but has yet to come into execution (IPPAN member).

It seems like domestic funding of hydropower projects is one of the main solutions to the depletion of foreign currency reserves, though PPAs in Nepalese rupees also bring problems

of payment. However, as mentioned, Nepalese investors are not able to finance the largest hydropower projects required for Nepal to reach the goals of the energy strategy. At least not without some foreign funding.

The issue is that there is not that much FDI in Nepal presently. The IPPAN member commented that since 2014-15 "Nepal don't have many foreign investors. Before we had, but at present very [few] are in Nepal". There may be several reasons why this is the case. One reason might be that the demand is not high enough in Nepal for there to be a market for the additional power. The Counsellor explained "If NEA cannot sell to its domestic consumers in Nepal, it has to find the consumers in India. If that is not possible it will be a risk to NEA to have big agreements with foreign partners". It will also be risky for the foreign investors, because NEA will not be able to pay the investors back without the consumers to purchase the power (The Counsellor).

One may say that foreign investors requiring to be paid in USD is a challenge for implementing the electricity strategy, because NEA does not have the reserves to pay PPAs in USD. Therefore, they cannot promise foreign investors to purchase their power. Thus, Nepal seems to be in need of a larger market for their future electricity generation projects.

4.2.2 The role of geopolitics for electricity generation in Nepal

Nepal has a difficult relationship with India, which influences negotiations over a power trade agreement between the two countries. Furthermore, Chinese participation in the Nepalese hydropower sector is also affecting those negotiations. This has stalled hydropower development in Nepal. This will be further described below, and I will discuss why this situation has occurred.

4.2.2.1 Nepal's export strategy

Nepal's strategy shows that they for a long time have desired to become an electricity exporter and build up the economy of the country through power sale. The question is, if they reach their goal of 15,000 MW, then what are they going to do with all the added electricity? According to the Nepalese consultant the government will say "'we want to sell it, we want to export it'. But who is going to buy it? That is a big geopolitical question".

Nepal is a small and land-locked country with an open border towards India in the South, and Himalaya blocking the connection to China in the North (IBN consultant). Faced with the question of who to sell to, the Nepalese consultant believed the government would say "we'll try to sell it to the highest bidder". However, the only logical choice is India, as building transmission lines towards China would be too expensive and challenging (Climate Advisor). Bangladesh has been presented as another solution, and they have signed several MoUs with Nepal. However, this would also require transmission lines through India, and thus approval from India (Norad Advisor). And according to the Nepalese consultant "that is not happening so far". Consequently, if Nepal wants to export power, they have to export it to or through India, and this requires India's willingness and permission.

4.2.2.2 "We are of course economically and financially dependent on India" (IBN consultant)

Hydropower development in Nepal is according to Sharma and Awal (2013) directly related to their relationship with India - even more so for export-oriented projects. The findings in this research also give that impression, and it therefore becomes relevant to take a brief look at the relationship between Indian and Nepal, both historically and now.

The story of the relationship between these two countries goes far back and is related to sharing of water resources, as mentioned under policy environment. According to Sharma and Awal (2013) the relationship has never been smooth. And since the reinstatement of multi-party democracy in the 90s, Nepal has had an "energy imaginary about achieving greater energy independence from India" (Movik & Allouche, 2020, p. 5). Despite of this, Nepal is still highly dependent on India for the import of a variety of goods. For the same geographical reasons as mentioned above, with Nepal being landlocked, Nepal must import almost all products from India, including electricity for parts of the year. Furthermore, Nepal has no known sources of petroleum and gas, and are thus also dependent on India to cover all their fossil fuel needs (IBN consultant).

The clearest example of Nepal's dependence on India to cover their energy needs is the mentioned blockade that took place on the border between India and Nepal in 2015. Several informants gave the impression that most Nepalese consider the blockade as something initiated by the Indian state, as they were displeased with the new constitution in Nepal. India, on the other hand, has not been willing to take responsibility for the blockade. The

Norad Advisor said that whether it was a blockade or not he could not say, "but from Nepal's side they experienced it as one". What is important is that the blockade resulted in complete halt in all import to Nepal, and therefore a fuel crisis, as petroleum products in Nepal quickly ran out. This gives connotations to the literature on the geopolitics of hydropower, and how interconnections of energy makes a state vulnerable to the actions of another (Hancock & Sovacool, 2018). The IBN consultant said "We lost access to gas and had to use firewood for fuel. I had to pay 6 times as much for petrol at the time". The blockade also led to delays in hydropower construction, such as for UTHL, due to disruption of equipment and staff from India (Informant 6).

The blockade exemplifies Nepal's ambivalent relationship to India. According to the Statkraft employee, Nepal in some respect looks up to India as a big brother, but one must not forget that "Nepal is one of the few countries in the world that has never been conquered. No one has managed". This accordingly makes them a very proud people, and that they in politics are not always willing to admit to their dependence on India. "They want to be self-sufficient, [and therefore] not admit that India is the key to investments in hydropower" (Statkraft employee). The IBN consultant mentioned that the blockade had also created "anti-India sentiments" in Nepal. This led to the delay of for example the Karnali hydropower project in western Nepal, where locals protested against the Indian company developing it (IBN consultant). These findings are similar to Vindegg's (2020), who found that the fuel shortage from the blockade revealed decades of India using halts of energy export to Nepal as a political tool to undermine Nepal's sovereignty. This in turn explains the resentments of Nepalese people towards India (Vindegg, 2020). The IBN consultant on the other hand, considered it relatively easy for Indian developers in Nepal today.

Another example of Nepal's dependence on India is the end of the load shedding period that lasted from 2008 to 2017. The new managing director of NEA in 2017, Kulman Ghising, often gets the credit for having changed distribution of electricity within the country, which favoured the industry (Statkraft employee). The NEA employee, however, pointed out that Nepalese people often neglect the fact that Ghising and NEA also arranged a new electricity import agreement with India, as mentioned in the system mapping. This is how they covered the deficiency in the country through import. Consequently, it was through the help of India the load shedding ended (NEA employee). Nevertheless, Ghising understood Nepal's

precarious position as landlocked between India and China, and how this required rethinking self-sufficiency and focusing more on energy security (Statkraft employee).

The consequence of the dependency

The consequences of Nepal wanting to export to India while also being highly dependent on them, is that Nepal is left with poor conditions for negotiating about electricity trade. The Norwegian consultant said that while the Nepalese thinking previously had been "if they don't want it, too bad for them", there is more pressure today on the government to obtain a deal with India to sell surplus electricity.

Nepal was not prepared for the sudden increase that UTHL provided to the grid, as it increased the total installed wet-season capacity in Nepal with around 40% (Norwegian consultant). The issue of a lack of market will grow as other large-scale project, such as Tanhau and Middle Bhotekoshi, come online the next 5 years (Informants 6 and 13). The WB Specialist said "Typically, these large-scale hydropower projects look very attractive, but you know, Nepal's domestic market is very small in terms of demand. Until Nepal manages to raise internal consumption, they must therefore export the surplus electricity, lest they spill the water from the power plants (IBN consultant).

The issue for UTHL is that the plant is already online, while India is not willing to import enough electricity to take the wet season surplus. As a result, the brand-new power plant had to run on minimal production, and NEA still had to pay for all the power. The Norwegian consultant therefore expressed:

> *What's [foolish] of Nepal is that they put themselves in this difficult situation domestically, before they had a deal with India. Because now India knows that Nepal is in a [pressured situation]. They didn't create the best position of negotiation for themselves (Norwegian Consultant).*

The IBN consultant was of similar opinion, stating that India would use the dependency to their advantage and set the boundaries. This seems contrary to Blondeel et al.'s (2021) theory that electricity trading is likely to be more symmetrical than that of oil and gas. The IPPAN member on the other hand was positive that UTHL would be allowed to export from UTHL soon if only the government "make India confident that we are not going to export power from where they don't want".

4.2.2.3 India's relationship to China

A conflict between India and China also influences electricity development in Nepal today. The dispute concerns an official legal border between the two countries, west of Nepal, which China has never accepted. Tensions have been on and off since 1914 or before, sometimes turning into outright war (Goldman, 2020). According to Hatlebakk (2017) the dispute may explain some of India's recurring involvement in Nepal's domestic politics, because they have security interests in maintaining Nepal as a buffer-zone against China. China, on the other hand, has "always respected that Nepal is under India's sphere of interest" (Hatlebakk, 2017, p. 32).

The effect on Nepal's energy development is that India will only accept imports from specific hydropower projects In Nepal. This is evident from the Indian equivalent to NEA in February 2021 issuing the "Procedure for approval and facilitating import/export (cross border) of electricity by the designated authority" (CEA, 2021). The document effectively restricts the import of energy to India from another country, if a third country without a bilateral power trade agreement with India is involved. The document itself did not mention China, but it is clear from both Nepalese news outlets and from informants that this restriction was aimed at blocking Chinese actors benefiting from the Indian power market (Shrestha, 2022b). For example, the IBN consultant said that the cross-border agreement meant "any energy projects where the investment is more than 50 % from Chinese developers, India will not purchase power from Nepal". And apparently, though the phrasing of the document might not have been pointing to China directly, IPPAN has been contacted by Indian actors who had said outright that "they won't buy electricity from projects with Chinese investment and even projects built by Chinese contractors" (Shrestha, 2022b). The IBN consultant explained that though India did take the opinion of GoN into consideration, finally it was India's will - "[India is] a big country and can make [those kinds of] policies. But that limits investment in Nepal".

These findings – both in relation to Nepal's dependency on India and India's conditions for import – gives connotations to Newell's (2021) theories on how countries with low influence on trade relations and status as importer or exporter, see reduced policy space or autonomy to pursue their favoured energy pathway (in this case, their export strategy). The findings also point to the literature on how differential power relations determine who benefits or not in certain energy pathways (Newell & Phillips, 2016).

Another perspective came from the researcher from Cicero, who did not think the debate on the import of power was particularly central in Indian energy politics. Regarding their own energy supply, India is more focused on becoming less dependent on oil imports, over which they are also competing with China. Several exporting countries see China as a better market. "Consequently, there is a great deal of geopolitics in this picture" (Cicero researcher). The Counsellor had a similar perspective, saying that Nepalese energy was "peanuts to India" - an insignificant amount of energy. For India, he thinks the main interest is water and bilateral relations, and the electricity is just a bonus.

When India for the first time opened for Nepalese power to be sold to the Indian power exchange in November 2021, they would only take power equivalent to two hydropower projects that were developed with Indian contribution. Those were the Trishuli and Devighat hydropower projects with a total installed capacity of 39 MW (Shrestha, 2021a). UTHL however, which came online a few months *before* India opened for import, has as mentioned not yet been allowed to export power to India, and as a result had to spill a great deal of water. Some of the contractors working on the construction of UTHL were Chinese companies, but as mentioned, the ownership of UTHL is Nepalese (Shrestha, 2022a).

In sum, Nepal's export strategy is hampered by Nepal's dependency on India, and further by India's relationship to China. One could say that there is a relationality between the mechanisms within Nepal and the processes happening at another political level. An important question is therefore what implications this has for actual construction of new hydropower plants? This is analysed below, through a large hydropower project that exemplifies these implications well. The project is called Tamakoshi III, was initiated by Statkraft in 2007 (Statkraft, 2016).

The relationship with India stopped a project twice

Aside from Khimti I, Statkraft in the constellation SN Power was involved in one other hydropower project in Nepal, which they in the end never developed. The project was supposed to generate 650 MW, and was planned to be financed by the WB and the ADB. All the initial development and surveying was financed by their own resources. The informant from Statkraft explained that the Government of Nepal at the time was very happy about this project. They had the idea that with Tamakoshi III "we can end load shedding". However, Nepal was not ready for such a large project, and neither was Statkraft – "it was a hard lesson learned" (NEA employee).

Statkraft dropped out because there was no market for that much power in Nepal at the time, referring mainly to the low domestic consumption (Informants 1, 6, 14). The NEA employee pointed out that Tamakoshi III would have faced even larger problems compared to the situation of UTHL today, due to the project's high installed capacity. There was also no framework or technical solutions to export to India. If Statkraft had built even more projects, they could have dedicated a transmission line directly to India to export their own power, but the Norwegian consultant thought direct export never really became relevant.

Statkraft themselves issued a formal letter to IBN January 5th, 2016, where they listed reasons for why they withdrew from the project. The summarized version of why they withdrew is:

> *A lack of viable power offtake option, lower electricity price forecasts, insufficient transmission capacity for power evacuation and absence of necessary policies and regulatory framework for operationalizing power sales. It also reflects the increased bureaucratic hurdles for foreign investments, a fragile political situation and a geo-political situation leading to a non-conducive project development environment (Statkraft, 2016).*

Three of the 6 listed reasons relate to a lack of opportunity to export the power from Tamakoshi III to India. The informant from Statkraft believed that it must have been "thought-provoking" and a "big disappointment" for the government that an actor the size of SN Power and Statkraft gave up Tamakoshi III. This is because many big Indian companies at the time were on their way to withdraw from other projects, as they could not make the projects commercially viable. Lastly, he thought Statkraft backing out made Nepal realise that it is necessary to develop more by themselves and take more responsibility as a country - "but then again they kind of lack both the capital and resources and capacity to do it".

Tamakoshi III got delayed for many years after Statkraft pulled out, and it has "not moved in a smooth way since" (IBN consultant). There were negotiations with several companies until the licence was given to a collaboration between one Nepalese and two Chinese companies (Rijal, 2019). Because of the Chinese participation the IBN consultant explained that "they will not be able to export to India. They can export to China but that is very difficult".

In sum, when Statkraft first backed out of Tamakoshi III, an important part of the reasoning was that exporting to India was not possible yet, and would not be in the near future. Thus, Statkraft would not have a market for their power (Statkraft employee). In addition, NEA

was not willing to give a guarantee for all the power purchases. Today Tamakoshi III has again slowed to a halt as it will not be able to export to India with Chinese investors involved in the development, and as there is no market for the power within Nepal with the current levels of consumption. This is one answer to the implications of the complicated relationships between the three countries. Regarding the Indian restrictions on Chinese investments in hydropower the IBN consultant said "You can speculate that this means more Indian investors will invest in Nepal" and made a reference to Arun III being developed by Indian SJVN.

When hydropower projects are developed by Indian actors

The Arun III project is quite contrasting to Tamakoshi III, as it will be exporting electricity directly to India. This project also has a long and complicated history, as it was originally to be financed by the WB, who withdrew from the project in the 90s (NEA employee). The project lay untouched for many years until an MoU was signed between the Government of Nepal and Indian publicly owned development company SJVN, in 2008 (SAPDC, no date). The construction of the project began right after the Nepalese 2018 white paper which gave "lucrative incentives to developers" was ratified (IBN consultant). The project will have an installed capacity of 900 MW and is designed as a PRoR-project (SAPDC, No date). Amongst other things, the agreement between the GoN and the Indian developers also states that when the project is completed, a portion of the power will be given for free to Nepal. The rest will be sent with new transmission lines directly to India and sold under normal conditions on the Indian power market (IBN consultant). Contrary to Tamakoshi III, this project shows that there is some willingness from India's side to import electricity, as long as it happens on their conditions.

4.2.2.4 The difference between Chinese and Indian FDI to Nepal

Both Arun III and Tamakoshi III exemplify how much easier it is for Nepal to reach their implementation strategy if they can get Indian companies on board. As mentioned previously, there is not much FDI available to new hydropower projects in Nepal at present time. The exception is Chinese companies, which according to the informants from IBN and IPPAN are the only ones eager to develop projects in Nepal at present. In fact, several Chinese multinational companies have started projects in Nepal today. More Indian companies showed interest before, but currently, only a few projects are funded by Indian actors. "Other than that, we don't have any options" (IPPAN member). The Climate Advisor

attributed the absence of other foreign developers to a lack of policies that attract foreign investors. Further, the lack of such policies might be due to the Nepalese government fearing ending up in a situation of high foreign debt. He drew a comparison to Sri Lanka and African countries, where several are highly indebted to China, as China was the only willing party to develop their projects. His comment is similar to literature on the role of China in developing countries (Power et al., 2016). Chinse debt could become an issue for Nepal as well, and therefore the Climate Advisor thought Nepal needed to "strike a balance" in terms of attracting FDI but also have the capacity to pay. The Counsellor explained similarly that Nepal could export several thousand MW to India or Bangladesh, but "Nepal is treading very carefully in this area because you also have the situation between India and China. And if they deregulate too much, obviously, they could be flooded with Chinese investors or even Indian investors".

An unanswered question after looking into these issues is why Nepal still chooses to accept Chinese investments in the hydropower sector when it will limit their access to the Indian market. One explanation might be as mentioned that Nepal needs large sums of foreign capital to finance its development strategy, but few actors of FDI are currently willing to invest in new Nepalese hydropower projects. To reach their goal of 15,000 MW by 2028 it might therefore seem inevitable that Chinese investors should play a role. However, the Counsellor explained that it is tricky for Nepal to find a balance between their "huge need for investment" and remaining in control in relation to India and China. This also points to power relations being at play and shaping energy development, similar to what literature finds (Newell and Phillips, 2016). Understanding why there is little progress on Nepal's export strategy thus requires a look at "the larger sort of geopolitical climate" (The Counsellor). A factor making the situation more difficult for Nepal is that Nepalese political parties often hold certain ideological sways towards either of the two countries (The Counsellor), a topic that will be revisited later in the chapter.

Another perspective on what lay behind Nepal's decisions to keep on accepting Chinese investments in hydropower came from the Climate Advisor. He pointed out that the relationship between India and Nepal, as well as India and China, is not static, and therefore the difficulties Nepal sees today could change "The next time Xi Jing Ping and Modi could have a meeting things could settle down a bit (…). So these things just go up and down" (Climate Advisor). An explanation could therefore be that Nepal keeps pushing for hydropower development because they hope the situation will improve.

4.2.2.5 Third-party efforts for cooperation between Nepal and India

Several informants pointed to third parties that might be improving Nepal's situation in relation to India, and it therefore becomes relevant to see how they influence progress. The Climate Advisor could point to several actors and institutions, like the British and American embassies and USAID, which are all getting involved to arrange a deal between Nepal and India regarding power trade (Climate Advisor). Whether this is working remains an open question. However, Hatlebakk (2017, p. 13) found that "third-country support for transmission systems could help Nepal in their bargaining with India over export". This points back to bilateral aid to transmission as a progressing factor.

One of the more influential actors working for increased electricity trade seems to be the South-Asian Association for Regional Cooperation (SAARC), where India is a key player (NEA employee). SAARC is currently working on making an energy ring or super grid in the region.

The idea of the super grid is to connect the electricity grids of all the member states. It will mainly be the smaller states like Nepal and Bhutan supplying the larger ones like India and Pakistan, because they are the ones with electricity surplus. Another possibility is that Nepal and Bhutan can export electricity in their wet-seasons and import during dry-season, which is opposite of India and Pakistan's seasons (Informants 7 and 8). The super grid has according to the two SAARC-informants many potential benefits, but also some technical and economic roadblocks. The main issue is getting all the parties on board. "Politically, not all countries would like to have an external dependency for their energy needs. That is one limiting factor" explained the SAARC researcher. Furthermore "there is a politically charged environment in south Asia". This he attributed to India being placed in the geographical centre of the region, and therefore any regional trade must go through India. India's power over energy trade seems to extend beyond Nepal. However the SAARC researcher thought the presence of China as a limit to exports was a problem unique to Nepal, compared to the rest of the region.

The only missing signature for the ratification of the super-grid agreement is from Pakistan. There has been no official word as to why they have not ratified, but it could be due to Pakistan and India's difficult relationship. What was clear for the SAARC researcher was that "Until that is solved the regional ring will not happen". Nonetheless, energy trade has been increasing in the region the last 10 years (Informant 7 and 8). As both India and Nepal have signed the SAARC-agreement it seems curious that India is so reluctant to accept

Nepalese exports. The SAARC-informants did not have an answer to why this might be the case. It might be due to cooperation in SAARC being mainly bilateral, with the implication that the success of the energy ring depended on the relationships between the countries.

A last third-party worth mentioning is a private sector power exchange company established two years ago by members of IPPAN, called Nepal Power Exchange Ltd. The purpose is to sell Nepalese power to the Indian power exchange. They have received consent from India, but with guidelines in the process of being finalised they have yet to receive consent from the Nepalese government to conduct the trade (IPPAN member). The informant from NEA said consent would be given, perhaps within a year.

This yet again displays that India shows *intent* to import from Nepal, but that several factors such as within Nepalese politics influence when or whether it will happen. In sum, it does not seem like third-party efforts have contributed much to solving Nepal's issues with exporting to India.

4.2.2.6 Increased focus on consumption in the Nepalese electricity strategy

It seems like the difficulties Nepal has faced when trying to establish electricity export to India has started a slight shift in strategy in Nepal. While electricity conservation was needed during the load shedding days, the government is now working on increasing domestic consumption as an alternative to exporting to India. State agencies such as AEPC and NEA have been advocating for the same (Climate Advisor and AEPC officer). The shift from electricity deficiency to surplus represents a shift in Nepal. The Norwegian consultant explained that there 20 years ago was focus on "there is a crisis in this country. We don't have enough power". The current situation has created a recognition that "they are balancing on a knife's edge to balance production and consumption, as long as there's not a bigger market to take the power" (Norwegian consultant). This seems like an example of how powerful actors can shape visions and ideas in energy development policies, and how they are implemented (Newell & Phillips, 2016).

Increased national consumption would be beneficial or lead to progress in several ways. In general, a reduction of imports would according to the AEPC officer mean improved energy security. If Nepal further diversified electricity production and started using more sources such as solar power, they could further improve the energy security (AEPC officer). Improved energy security would in this case mean Nepal would be less vulnerable to both

price fluctuations in Indian fuels, as well as less vulnerable to geopolitical conflicts such as between India and China. Second, Nepal wants to expand their industrial sector, which would be aided by more domestic electricity in the grid. Further, switching to electric vehicles and induction cooking could reduce the import of petroleum products and LPG from India, which is good for the trade deficit of Nepal and their low currency reserves (Informants 5, 11 and 12). However, as pointed out by the IBN consultant, "Import of petroleum products is increasing drastically every year", and as a result Nepal's foreign currency reserves keeps on decreasing.

The work of increasing consumption is led by the government and conducted by AEPC, through for example subsidies for induction cookers and electric vehicles in Nepal, as mentioned. NEA has also been involved, but the NEA informant pointed out that increasing consumption is very difficult. It depends on many factors such as the financial situation in the population, which is not good. Another explanation could be related to AEPCs position within the MOEWRI, which will be addressed in the next section. How this work of increasing consumption is progressing is less certain, but the water spillage from the first season of electricity surplus points to the problem not being solved yet.

4.2.3 The role of climate and environmental issues for electricity planning and implementation

This theme is included in the data collection and analysis because early readings pointed to Nepal being highly vulnerable to climate change. This section will therefore focus on whether or how climate change and related initiatives influence progress around the electricity strategy. Firstly, I will comment on how it has shaped the strategy and discourse of electricity development in Nepal, and then continue by looking at whether climate financing mechanisms have affected implementation. Lastly, this section addresses the potential influence of Indian climate commitments on implementation of the electricity strategy.

4.2.3.1 The Influence from climate change agreements

Despite of Nepal being a signatory to international agreements on climate change, Nepal's electricity strategy seems to be mainly informed by other interests or concerns. For example, Nepal's electricity strategy has moved from being entirely supply-driven, over to also setting

targets for increasing electricity access and consumption in the population. This has brought it closer to the more "access-oriented" Sustainable Development Goals (SDGs) (Nepalese consultant). However, the Nepalese consultant did not believe the orientation was due to the SDGs, as the submitted targets are still "all about" hydropower. The informant rather thought it was Nepal's electricity strategy steering their climate change strategy. Furthermore, Nepal has previously searched for natural gas and oil in Chitwan National Park. No finds were made, but "there was a lot of political support for that research" and Nepal would "definitely strike that opportunity" if finds were made (Climate Advisor). This is similar to literature on how the position of environmental issues on developing country agendas are often displaced by problems of greater priority, such as the importance of natural resource for economic development (Newell, 2014).

It can thus be interpreted that international climate change agreements have had little influence over the Nepalese electricity strategy and its progress. Why this is the case could be explained by other concerns being more dominant within the state. For example, AEPC was previously placed under the Ministry of Environment, Science and Technology. Their work was then more concerned with climate change than today. After the move to MOEWRI, the focus of their work has shifted towards energy security and diversification. This might be because the government is more concerned with these two areas than before (AEPC officer).

Another possible reason why climate change agreements have not had a larger influence is explained by the position of AEPC. Matters concerning climate change and energy are still under the sphere of AEPC, even after the move to MOEWRI. The same goes for increasing electricity consumption (AEPC officer). However, they seem to have a weak position within the MOEWRI. Informant 6 has previously worked with APEC. He explained how AEPC could make the needed plans, but it was still NEA and MOWERI making final decisions "and if they thought something else it turned out how the Energy Ministry [wanted]". This reminds of literature pointing to ministries of energy together with energy utilities often wielding more power than other state agencies, due to the importance of energy to economic development (Newell, 2021). Though both AEPC and NEA are placed under MOEWRI, a report on AEPC's role found that they are less influential than their counterparts (Amatya et al., 2019). Thus, whether climate change and environmental issues play a role for Nepalese electricity generation seems to also be influenced by dynamics within the Nepalese state.

Despite this, the Climate Advisor thought concern for environmental and social safeguards and risk is increasing in Nepal.

4.2.3.2 Influence from natural disasters and climate extremes

Natural disasters and climate extremes seem to have had large negative consequences on the progress in electricity development. Nepal is ranked fourth, eleventh and thirtieth of the countries most vulnerable to risks of climate change, earthquakes and floods respectively (UNDP, No date). All these factors are affecting hydropower development at a local level (Agrawala et al., 2003). For example, UTHL was very close to the epicentre of the major 2015 earthquake in Nepal, which resulted in the destruction of their construction roads, powerlines and the concrete of the dam. Project completion was therefore delayed (Norwegian consultant). Landslides also frequently block construction roads or rivers, or destroys other hydropower-related infrastructure (Nepalese consultant). Another issue is glacial lake outburst floods (GLOFs), which completely wrecked the Bhotekoshi hydropower plant in 2016 (ICIMOD, 2019). Several other plants are at risk (Informants 1, 5 and 10).

A consequence of such events is that the cost of hydropower development is increased due to additional risk-mitigating measures. According to the ERC Commissioner, addressing the risks also makes the cost of the electricity higher, and that cost will be passed on to the consumers. ERC is therefore involved in developing cost-reflective power tariffs (ERC Commissioner).

Another impact of these natural and climate-related impacts could be a change of discourse around the risk of hydropower development. Hydropower has generally been seen as a safe and profitable investment in Nepal, which initially made more domestic private investors get involved (Informants 1, 6, 14). Furthermore, electricity development used to be seen as just a source of revenue, and environmental and social aspects were mostly ignored (Nepalese consultant). With the increasing natural and climate risks, this discourse might be changing. For example, the Nepalese consultant said the 2015 earthquake created a discourse that “our hydropower projects were very vulnerable to disasters”.

The natural and climate change risks to hydropower seem to have contributed to a realisation that diversification of the electricity mix is needed to enhance energy security. While the thinking previously was that technologies like solar and wind power were too

expensive for Nepal, the thinking is becoming that Nepal cannot afford to *not* develop alternative sources (Nepalese consultant). The 5-10% quota for alternative renewables in the 2018 strategy is an example of this change in thinking. AEPC was a major advocate for this quota (AEPC informant). Combined with the cost of solar power coming down, the risks to hydropower have made more actors work for development of alternative sources of electricity (Nepalese consultant and Climate Advisor). This could be an example of how global warming, as a broader dynamic that influences socio-technical systems is shaping what is desirable for a country (Byrne et al., 2020). That being said, the IPPAN member meant few private sector actors are interested in solar power investments up till now.

The capacity in Nepal to address environmental risks were questioned by several informants. The Nepalese researcher explained that local level capacity to ensure the implementation of climate risk sensitive strategies for hydropower projects was too low. In some local governments, only one employee is looking after such concerns (Nepalese researcher). According to the Statkraft employee "Nepal hasn't been able to afford to include all those environmental requirements in their legislation yet". This is similar to Newell's (2014) claim that materialising resources and organising bureaucracy sufficiently to impose and monitor climate concerns into energy projects in developing countries is a challenge. In sum, climate and environmental risks have delayed projects on local level, but also started a change of discourse politically. However, Nepal has a capacity problem with addressing these risks.

4.2.3.3 Climate financing mechanisms

Though findings pointed to the Nepalese electricity strategy not being influenced much from climate change agreements, they have still conditioned their emission cuts in their NDC on "availability of finance" (Climate Advisor). This means they will implement more measures to cut emissions if they get financial assistance from outside to make the change. In the NDC, Nepal committed to finance 5,000 MW hydropower of their goal of 15,000 MW by 2028 from domestic resources. The other 10,000 MW are conditioned on "international investments from the climate agenda or from international climate finance" (Climate Advisor). In the previous Conference of the Parties (COP26) the required amount was estimated to be around 2 billion USD yearly (ERC-informant).

One of the main modalities for climate financing for developing countries is carbon credit systems such as the Clean Development Mechanism (CDM). The mechanism provides funds for developing projects that leads to emission cuts (Informant 3, 4). Nepal does not have any

hydropower plants above the smallest scales registered under the CDM as it is very challenging to use, even for energy systems on household-level. The reason seems to be that with all the accounting and monitoring required to register how much emissions have been reduced, the projects become financially unviable (Informant 12). Furthermore, according to the Counsellor, the amounts accessible from the mechanism are also "definitely not enough".

The other modality is the Green Climate Fund (GCF), where Nepal is conducting several smaller programmes (Informant 3, 4). The Green Climate Fund has different categories of loans that depend on the risk level of the project. According to the Counsellor, it is very tedious and painstaking to get funding for even the lowest-risk projects. For example, to apply for a 30–35 million dollar project, it takes more than 5 years. "Just imagine how long it's going to take to apply for projects that are worth 200-300 million dollars you know, like, how many safeguards processes you have to ensure" (Climate Advisor). The time-consuming process of applying and fulfilling all the environmental and social criteria also makes the cost of the project increase. When asked who Nepal should turn to, as GCF was not a good option for the large hydropower projects, a Climate Advisor said "in terms of huge investments, it will definitely be the World Bank, and the ADB". Consequently, it seems climate financing mechanisms in their current form have had little influence on progress in Nepalese electricity generation, beyond the projects at the smallest scales.

4.2.3.4 The future hope of Indian climate change commitments

It seems international climate politics have had little influence on Nepalese electricity development so far. India, on the other hand, is both highly reliant on coal power, as well as a larger player in the climate change regime. The section on geopolitics showed that India has opened for importing a small amount of electricity from Nepal, but on very strict terms. For these reasons, many actors in the Nepalese energy system see Indian climate commitments as a potential door-opener for increased imports from Nepal. For instance, one of SAARC's main arguments for the earlier mentioned regional super-grid is its coal power emission mitigating potential (Informant 7 and 8). WB's own climate commitments also make them focused on reducing coal power generation in India to mitigate emissions, with Nepalese hydropower export being a key modality (WB Specialist).

Two questions that arise are whether India really needs Nepal's electricity, and whether their commitments internationally will lead to more electricity imports. Regarding the current demand, there were highly conflicting opinions between for example the Statkraft and the IBN informants. Others, such as the Cicero researcher, thought Indian electricity demand might grow in the future. Despite of these conflicting views, several informants (from IBN, IPPAN and Cicero) thought Indian climate change commitments would make them import more electricity from Nepal in the future. India has recently committed to *reduce* their coal power generation in the COP26 (Ellis-Petersen, 2021; Informant 15). Nevertheless, the NEA employee said "if they really wanted to meet that target, they could have easily invested and bought the power from Nepal. But they are not doing that". What seems evident is that Indian climate change commitments are not helping Nepal solve their export problems today, and thus have not contributed to progress for Nepal as desired. This seems in line with Newell's (2014) theory that climate change politics can meet barriers through variegated interest at multiple levels of governance, such as in the Indian state. Whether international climate change commitments will come to influence Nepal in the future remains to be seen.

4.2.4 The role of Nepalese political characteristics

While the three broad contextual factors above were hypothesised to influence the progress of electricity strategy implementation before data collection commenced, this fourth factor was included subsequent to data collection. It involves characteristics or mechanisms within the state and political system that informants pointed to as having implications for hydropower development. Including state factors is in line with Cherp et al.'s (2018) framing of socio-technical energy systems, where the state is an ordinary economic actor or factor in line with the other actors. These domestic dynamics are highly complex and could each have been a study of their own. Giving a deep explanation is therefore beyond the scope of this thesis. However, I find it necessary to mention them because they are important on their own, and due to the way they relate to the abovementioned factors.

4.2.4.1 Ambitious targets for hydropower generation, but lack of concrete plans

Nepal's strategy for increasing electricity generation involves some very ambitious targets. This was pointed out by several informants. While some said that the target of 15,000 MW

by 2028 was realistic, the informants from IPPAN and ERC did not think so. It was also pointed out that as governments have changed, which has happened rapidly since democratisation began, the targets have become increasingly ambitious (Climate Advisor). This has happened despite Nepal being in a situation of load shedding and progress in hydropower construction going very slow. According to the IPPAN member, this proves that the government's policies and efforts have not been working as intended. A question that arises is whether the politicians setting the targets themselves believe they are realistic or not. If they do not consider their own targets for electricity development realistic, then what are they trying to achieve with them? One informant thought the purpose of the ambitious targets were to attract foreign investments, which they have been reliant on since they started privatising the energy sector in the 90s (Climate Advisor). Using an ambitious strategy as a tool to attract investments is similar to socio-technical system literature on how narratives are used to mobilise around important issues for the system (Byrne et al., 2020). It seems like this narrative might have worked in the period immediately after the promulgation of the new constitution, with Nepal seeing many new investors come to the market, as mentioned. But with the lack of export opportunities for the additional electricity the sector is again struggling to attract investors. This again shows how contextual factors such as geopolitics interrelates with work and strategies on the state level.

Why the target or narrative is not working today might be due to insufficient planning by the state. The electricity-related policies, such as the 2018 white paper, have both set targets and written plans for how to achieve them. The problem seems to be that the plans are not good or foreseeing enough, such as seen with the connection of UTHL (Informants 3 and 14). The ERC-informant for example, said "we have now 8000 MW in the projects in the pipeline, but we do not have a proper plan for consumption. That's why we are worried now". The Energy Advisor similarly thought implementation in the electricity sector was mostly "ad-hoc" meaning they solve the problem that arises rather than follow a plan. For example, "if there is a problem in transmission then the strategy is to focus on transmission" (Energy Advisor). Lack of sufficient planning could thus explain how Nepal ended up in the difficult situation of no market for the new electricity generation.

4.2.4.2 Ideological differences between political parties

Nepalese politics have been described as generally unstable or chaotic, which has consequences for hydropower development (Statkraft employee; NEA employee). Since

Nepal became a republic in 2008 rapid shifts in government have been a characteristic of the state. These shifts have also often led to large replacements of the state bureaucracy. Another characteristic is a left-wing of parties established after the Maoist insurgency. On the other side of the political spectrum there are monarchist parties with affiliation towards India. There are also Madhesi parties from the border towards India (Giri, 2021; Hatlebakk, 2017; Roy, 2017). Going into inter-party conflicts and coalitions is beyond the scope of this paper. However, it is worth mentioning that the initial Arun III-project was stopped for such reasons in the 1990s.

Though there are many more recent examples, the Arun III-project is illustrative of how challenging the political climate in Nepal is. The project was considered a high-priority part of the state's least-cost generation plan and was supposed to be financially supported by many development actors, such as WB. Before construction began, a political party started critiquing the government for not having attained a national consensus or looked at other option before initiating the project. The party sent a letter to the WB in 1994 to express their concerns around the project and misgivings about the government. The WB then decided to back out, and in the aftermath a "blame game" was launched among political parties on "who lost Arun-3" (Dixit & Gyawali, 2010, p. 109). Arun III was put on the shelf until the current Indian developers picked it up years later.

Today, mostly Chinese companies are willing to develop projects in Nepal, while several Indian projects are under construction, such as Arun III. According to Sovacool, Dhakal et al. (2011) this often leads to conflicts between the blocks of Nepalese parties over where the financing for large hydropower projects is coming from. For instance, projects developed by Indian actors are often blocked or critiqued in parliament by the Maoist-block of parties "on the grounds that it would not benefit Nepal" (Sovacool, Dhakal, et al., 2011, p. 3474). The Counsellor explained that investments from these two countries often leads to debate over Nepal's sovereignty. Accordingly, sovereignty is often used as a "tool" by political parties to gain popularity. For instance, during elections a party may gain favour by saying "that another party has done something that has harmed our sovereignty". This relates back to the mentioned anti-Indian sentiments after the 2015 blockade and Nepal's dependency on India. Here one sees the usefulness of taking a relational approach to energy development, as it brings out the intricate interaction between national and international events and actors (Newell & Phillips, 2016). The consequence for progress in the system seems to be that projects are either delayed or stopped completely.

The image is however not that bleak. Despite of these debates over foreign influence there is still a consensus on the development of hydropower among political parties in Nepal. There are also instances where the political parties have joined forces to improve procedures and facilitate hydropower development (Wahid et al., 2016).

4.2.4.3 Corruption as a limiting factor

According to both informants and previous research, corruption is a big problem in Nepal in general. For example, in their review of socio-technical barriers to hydropower plants in Nepal, Sovacool, Dhakal et al. (2011) found corruption to be a barrier, though they were not specific as to how.

According to the Statkraft employee, corruption is a great liability for developers in Nepal, and "one of the biggest problems for getting serious actors to Nepal". Similarly, the Norwegian consultant explained that the difficult business climate in Nepal and high risk of corruption was an important reason why the company he worked for was not more established in the country. Furthermore, he explained that it if you were not willing to pay, it was difficult as a company to get into the energy sector and win bidding rounds.

Corruption seems to be related to time. For instance, if a developer chooses not to pay bribes every process "that other people use 10 minutes on, [will take] 4, 5, 6 months" (Informant 10). An example goes a few years back, when there was a controversy around the Nepalese investor who obtained the licence to develop Tamakoshi III. Apparently, they obtained the license much faster than what is normal, which caused speculations about corruption (Informant 10). Such speculations seem to be common for Nepal and the electricity sector.

Several informants also talked about the load shedding period, and why it ended. Accordingly, the director of NEA at the time acted against state officials who had been accepting bribes by industry actors. The bribes were used to prioritise electricity for Nepalese industries over the residential sector (Informant 10 and 16). The corruption might have been happening in the Load Dispatch Centre, who instead of instantaneously distributing electricity planned and sent more to industrial areas (Informant 16). As mentioned, why load shedding ended is discussed, but these informants agreed that there was wide-spread corruption in the state apparatus at the time. As for today Informant 10 pointed to corruption in the state being due to how the state bureaucracy expands after elections as the elected party adds 'their own people' in. In sum, corruption in the Nepalese

state seems to influence hydropower development in several ways. An important one being that actors not willing to participate in corruption are deterred from investing, or must face slow and increasingly bureaucratic processes to obtain the paper work they need to construct projects.

4.2.4.4 Local opposition to hydropower projects

Several informants pointed to local opposition or conflicts around hydropower projects in Nepal as a factor leading to delays in the construction of plants (Informants 1, 3, 5, 10, 14, 16). Firstly, local conflicts were a large problem under the Maoist insurgency. Several hydropower projects got dragged into the conflict, through for example communication systems being destroyed, infrastructure or parts of the plants blown up, or fighting around the plants (Statkraft employee).

Today, demands from local population regarding compensation for how they are impacted is common. It could also be related to expectations towards the developers not being met, such as promises of local employment (Nepalese researcher). This seems related to literature on how consultations around energy projects and perception of people's needs have influence over energy development (Newell, 2021). When demands or expectations are not met in Nepal, it has caused obstructions to hydropower plants, or protests hindering construction vehicles, for instance. The Climate Advisor also described how indigenous people and local committees are getting more and more aware and vocal on social and environmental impacts and rights in Nepal. Earlier "it was very easy to relocate people and the state could do it easily". Today however, with Nepal being a democracy this is more difficult (Climate Advisor). The Statkraft employee similarly explained that after Nepal became a republic, demands to get benefits from local population around the Khimti plant increased.

Including projects being delayed, there seems to be a great deal of risk around the handling of local population and local impacts in Nepal. According to a Norwegian consultant, this makes it unpredictable and more challenging to develop projects in the Nepalese countryside. Some of the increase in demands may be attributed to the Maoist insurgency, which made people in the countryside see that they are not powerless. The consultant said this is noticeable during hydropower construction today. This is similar to literature on how change comes through power struggles (Geels & Schot, 2007). Though the consultant considered this positive for the local people, he thought Nepal could use more systems and guidelines on the impacts on local populations around hydropower plants.

5 Discussion

Based on the empirical analysis and theoretical framework, I will now discuss three questions that have emerged from the analysis, which all are related to Nepal's ability to follow their own energy pathway and reach their targets. Throughout I will also discuss how the factors investigated in this thesis relate and differ in importance for the progress of Nepalese electricity system.

5.1 How may each type of financing contribute to the current electricity strategy targets?

This first question is important as the filling of quotas described in the 2018 white paper could be seen as a way to evaluate the progress of the electricity development. Even though Nepal has gone from electricity deficiency to surplus, they still have far to go in terms of filling the different quotas. As shown in the analysis, there are many potential sources of financing for Nepalese electricity projects. I will address 6 key ones here, and I will discuss the importance of each in terms of their contribution to the strategy.

Firstly, commercial loans from Nepalese banks are used by many Nepalese developers. The issue with this type of financing is that it is impossible for Nepalese developers to acquire equity for anything larger than medium sized run-of-river projects. That is, unless they join forces with the state as in the example of UTHL. They are also not very interested in small-scale projects. The consequence is that the quota for RoR-projects established in the 2018 strategy is now full, and that issuing of new PPAs has stopped, as mentioned. Thus, this type of financing can contribute to progress relating to one specific scale and source of electricity, up until a certain point. That being said, if all the developers with a licence for a mid-sized hydropower project develops them before issues with export and consumption are solved, then NEA will be looking at a situation of bankruptcy.

Second, loans from international finance institutions like the World Bank have been an important source of funding for hydropower projects historically. They are also a possible source for large-scale hydropower projects today, as evident from the Upper Arun project. However, private sector developers seem to shy away from these loans due to their strict

conditionalities, bureaucracy and audits. Consequently, institutional financing can in some instances contribute to large-scale projects, but is not without its issues.

Third is bilateral aid, which is no longer used for electricity generation projects, but rather used for transmission systems. As transmission is a roadblock for fulfilling Nepal's targets, their contribution could be seen as contributing to progress, but not in terms of the quotas specifically.

Fourth is foreign direct investment. The contribution of this kind of financing for the strategy seems to depend on who is doing the FDI. FDI from actors such as Statkraft demands that PPAs be paid in dollars. This leads to depletion of Nepal's continuously low currency reserves. NEA are therefore hesitant to issue new PPAs without a market to sell the added electricity to. An example of how this plays out is the mentioned BOOT-scheme of Khimti I. The scheme was much critiqued, in similar way to those mention in literature by Virtanen (2006). The difficult renegotiations of this scheme have resulted is Statkraft backing out of the sector. Thus, while FDI could develop large-scale plants, their demands in combination with NEA's lack of market has resulted in few such actors being present in Nepal today. Thus, it brings little contribution to the current strategy.

Chinese investors are still willing to do FDI in large-scale hydropower projects. This is similar to what Newell and Phillips (2016) have found for Chinese companies doing large-scale hydropower projects in South Africa and Mozambique. However, due to the issues of export as seen for the current developers of Tamakoshi III, this makes it hard for NEA to pay for the electricity. Then there is Indian FDI, either funded by the state or other sources used by Indian companies. This would have solved both the issue of currency and export, but aside from a few projects like Arun III they are not very interested in developing electricity projects in Nepal today. Furthermore, Indian projects like Arun III sells and exports the electricity directly to the Indian market, meaning though Nepal will get some free electricity, it will not help them reach their strategy as much as if they fund, construct, and export it themselves. This is similar to Hancock and Sovacool's (2018) theory that when the income from hydropower construction goes to firms in other countries the benefits of the project for the host country is lost. It is also similar to Power et al.'s (2016) findings that energy poverty often remains high in countries without the resources to funds the projects themselves, despite of foreign investment in new energy projects. This is because the value is captured elsewhere.

Furthermore, FDI-funded projects with either Chinese or Indian financing is more likely to raise political discussions on sovereignty in Nepal, with some political parties having affiliation towards China and others towards India. This causes delays for large-scale hydropower projects, as they get caught in inter-party conflicts in parliament. An example was for Arun III in its infancy. This is in line with Bridge et al.'s (2018) claim that actors' choices on investments are important in reproducing political power, and to promote self-interest and those of certain social groups. Aside from Chinese actors, and a few Indian projects, it thus in general seems no actors are eager to develop projects that go under the storage-quota of the 2018 strategy.

Another reason why this quota is not being filled relates to the importance of natural and climate risk, which has both led to increased cost and delays of projects. So, in one way, factors related to climate issues are very important for delays in hydropower projects under the current quota.

Climate financing is the fifth potential source of funding. The existing climate financing mechanisms like CDM and the GCF are currently used for small-scale renewables in Nepal, but they are too bureaucratic and tedious to use for large-scale projects. In their current form they are therefore contributing very little to progress with the electricity strategy. Thus, the argument by Newell (2014) that international environmental institutions are important due to their access to financial resources seems to not hold in Nepal's case. This was different from my assumptions before data collection. On the other hand, Nepal has conditioned some of their international commitments on access to foreign funding in their NDCs. They are thus in line with Newell's (2014) claim that some developing countries take an opportunistic view on climate policy to secure funding.

Consequently, the issue with acquiring financing seems to be biggest for the large-scale or storage projects, as these are considered riskier and therefore require more safeguards, conditions or equity. Mid-sized projects can be financed by Nepalese source of funding, but perhaps for that reason the quota in the 2018 strategy has been reached. The last option is small-scale renewables such as solar power, where there is still an open quota but few private sector investors, as mentioned.

It is important to note that the contribution of these sources of financing also relate to a lack of market for NEA to sell all the added electricity. However, all problems would not be solved through access to a larger market. For example, the climate risk or the equity

available to the domestic private sector would not be solved. Nevertheless, the market is vital for NEA to sell the electricity and thus be able to issue new PPAs without facing bankruptcy. Until the issue of market is solved, the delays related to different sources of financing seems to be helping NEA stay afloat, as mentioned. In that respect delays can be seen as positive.

Another important thing to note from these sources of financing is the importance of actors outside of the Nepalese state. Though the state level has a lot of importance in shaping energy pathways or strategies, their ability to reach it will be highly influenced by the presence of other actors such as multinational corporations and international institutions. This is also stated in political economy literature, such as by Newell (2021). Consequently, the lack of domestic funds and a market makes financial factors very important for the progress in the sector. And similar to what Newell (2021) writes, this has consequences for Nepal's ability to make an independent energy pathway. This leads to the second question.

5.2 Which factors have the largest influence on Nepal's autonomy in the electricity sector?

Nepal is seeing a great deal of foreign influence in their energy development, leading to a lack of policy space to follow an independent energy pathway (i.e. their own strategy). I will therefore discuss which factor has the most influence over policy space, and how the influence leads to delays in the electricity development.

A term used to describe such policy space in national energy development is "autonomy". Autonomy is limited mainly when the country is aid-dependent, when it is an energy importer, and if it has low opportunities to condition requirements on investors or influence global trade relations (Newell, 2021; Newell & Phillips, 2016). All of these seem to be the case for Nepal due to their lack of funds, as seen in the previous discussion. Low autonomy is also a result of neoliberalist policies embraced by the aid-dependent state. According to literature, they embrace such policies when they are imposed by other powerful states and institutions such as the World Bank. Newell and Phillips (2016) call this imposition "disciplinary neoliberalism".

Electricity development in Nepal seems be under the influence of disciplinary neoliberalism. As evident from the analysis, privatisation has been ongoing since the 90s, with a strong presence of IFIs like the World Bank and other large bilateral donors even further back in

time. Some of these mechanisms, like the mentioned policy credit scheme, seem like softer forms of conditionalities and influence, disconnected from the loans for large hydropower projects. However, they do have an influence on where financing to the energy sector should come from and what kind of projects are prioritised. There has also been some unbundling of the centralised energy authority NEA, through the creation of ERC. Consequently, these kinds of disciplinary neoliberalism could explain low autonomy in Nepal today.

On the other hand - as informants pointed to - though the private sector in Nepal has grown considerably and there is considerable push from IFIs, NEA has maintained a great deal of power and their position in the Nepalese energy sector. They use this power, amongst other things, to negotiate over PPAs with private sector actors. This is similar to Caldwell and Woolley's (1976, in Newell, 2021) claim that a state's desire for growth may be coupled with expansion of the state's role. There is also pushback on the unbundling from inside NEA. Perhaps it is Nepal's visions and goals, as well as political consensus around hydropower that has helped them maintain some of their mandate and autonomy in relation to disciplinary neoliberalism.

Furthermore, there are many Chinese energy investors, developers and construction companies in Nepal today. The presence of foreign investment, such as Chinese companies, implies that the sector is less reliant on the loans from the World Bank than before. This is similar to the literature showing how 'rising powers' such as India and China has the potential to rebalance the autonomy in developing countries. They do this by creating access to funding with less conditionalities than that of the WB (Newell, 2021). However, in the case of Nepal there are geopolitical factors that also influence the situation, as explained.

The presence of Chinese actors in Nepal limits Nepal's ability to follow their strategy of exporting surplus electricity to India, due to India's misgivings about China. Not only is a part of the Nepalese strategy to export power to India and earn revenue on the sale. Nepal is also dependent on this export not to spill their recent electricity surplus, as they are having trouble increasing domestic demand fast enough. Thus, while NEA and Nepal might be able to push back on disciplinary neoliberalism, trouble fulfilling PPAs has weakened their position in negotiation with India. Unequal power relations, as described by for example Siciliano et al. (2018), seems like a suitable conceptualisation of the two countries' relationship. With India's historical influence over Nepal and their increasing interconnection of energy grids, it seems this has large consequences for Nepal's policy space or autonomy. Consequently, what seems to be more limiting for Nepal's ability to

follow their chosen energy pathway and thus their strategy targets today then disciplinary neoliberalism, is their lack of autonomy in relation to their neighbour, India. Power relations or geopolitics might therefore be a more suitable explanation of what is limiting Nepal's autonomy to follow their own strategy, more so than disciplinary neoliberalism.

This is in line with theories stating that the risk of geopolitics having an influence on power development is highest when the central grid of a country is connected to another country and there is trade of electricity. However, that research did not include hydropower, and furthermore found that trade of renewable energy was likely to be more symmetrical than that of fossil fuels, unless one country always imports and the other always exports (Overland, 2019; Blondeel et al., 2021). That is not the case in Nepal, which is slowly moving from importer to exporter, but is still seeing the same limits to their energy pathway.

Consequently, while literature on the policy space or autonomy of developing countries points to disciplinary neoliberalism as a central limiting factor of autonomy in aid-dependent states, the situation in Nepal is different. Here, autonomy is even more influenced by Nepal's dependency on India, and the geopolitics of India's relationship to China.

5.3 How does the state adapt to its situation?

Lack of policy space might be a great roadblock for progress in Nepal's energy development, but as evident from the previous discussion, they are neither completely without autonomy, nor adaptability. Consequently, one must look at the details of what is happening 'inside' the state, and not see it as a unitary and static actor, to understand how the system adapts. This is important to further understand what drives or delays the electricity development.

For example, Bridge et al. (2018) claims that governments taking charge of energy as a state matter reflects their in reality limited capacity to deliver upon public concerns around energy security, affordability and climate change. In Nepal, however, it is important to point out that work is being done to increase domestic energy security, especially by AEPC. This attention seems to come from their experience with the blockade, and from failed negotiations with India leading to water spillage in their first season of power surplus. It might also come from increased risk of climate change impacts and natural disasters destroying power plants. This similar to Geel and Schot's (2007) explanation of how contextual developments can put pressure on an established system (or in this case the

'hydropower regime'), and push it to change. Furthermore, contrary to Bridge et al.'s (2018) point of ensuring affordability, NEAs PPA-negotiations with private actors might be seen as an attempt to deliver upon public concerns around energy affordability. They are trying to keep the prices low enough for Nepalese consumers.

A second point relates to the lack of market for the recent and future power surplus. As mentioned in the analysis, efforts have been initiated to increase domestic electricity consumption and thus expand the market for the coming hydropower plants. However, these efforts have not been enough to avoid the current situation in Nepal with water spillage in the wet season and electricity deficiency in the dry season. So, while the system in one way seems to be adapting, something must also be slowing down the efforts. This could point to the differential power relations among state actors (Newell & Phillips, 2016). Newell (2021) writes that energy ministries together with energy utilities often have more power than other state agencies due to the key role of energy in development. In Nepal, NEA has considerable power and are mostly focused on energy supply. Actors that could have contributed more to increasing consumption, such as AEPC, has much less power, as mentioned.

This may also be an example of how difficult it is to break the path-dependency of the established energy system in Nepal due to its "rules" (Geels, 2011; Ulsrud, 2017). The "rules", maintained by strong actors such as NEA, have been too focused on supply rather than consumption, for a long time. The 2018 white paper, promulgated after the election of K.P. Oli, is one such "rule" that strengthened the path-dependency. But as mentioned, this also opened for other renewable energy technologies. Thus, Newell's (2021) claim that changes within the state with time can create shifts in power balance and the direction of the system finds support in Nepal's case.

Another explanation to why the change in the system is slow relates to the lack of plans in the Nepalese state, as evident from the fourth factor of the analysis. According to Byrne et al. (2020) narratives are important for change or lack thereof in a system. The policies of the Nepalese state have reflected the most powerful state actors' narrative around increasing supply. Thus, the narratives have limited the ability to plan for what happens when surplus is reached. This again points back to the role of the "rules" of the established system or regime in Nepal.

In sum, the established energy system is not static, but changing very slowly and adapting and being reconfigured by factors that are both from within the regime and from its context.

This is similar to socio-technical theories on established systems (Geels, 2011). The consequence is the locked situation Nepal finds themselves in, in their shift from shortage to surplus. This discussion also shows how the state, or actors within the state are not passive and powerless. They are flexible to influences from contextual factors, and they use their power to adapt to and contest these factors in various ways, with the results being both progress and delays.

In sum, these three discussions bring out Nepal's difficulties with following their own energy pathway. The first discussion showed how access to financing limits this ability, as Nepal is reliant on foreign and private sector actors. The second discussion showed that geopolitics is an even larger limitation to Nepal's autonomy, both before the electricity surplus and now. And the last discussion showed how the ability to follow the energy pathway also comes from dynamics within the established system.

6 Conclusion

In this research I have been trying to understand which factors influence progress in the Nepalese electricity development. This is because despite the recent wet-season surplus, they have been struggling with increasing electricity supply for a very long time, and they are still far away from their current targets. The research has been done by collecting insight from people who have broad knowledge of the field, and who themselves have experienced the effects of these influences. The research question for this thesis was: "*Which political and economic factors influence the progress of Nepal's electricity development, and how?* To study this, I looked at the role of different sources of financing, geopolitics, climate change and environmental issues, and state characteristics.

6.1 Main findings

The most important economic factor today is domestic private sector funding. Due to Nepal's strategy for privatising the electricity sector, the domestic private sector for electricity generation has grown massively. This has led to faster progress in electricity development than before. This was not always the case, as an insecure market due to domestic conflicts seems to have led to license-trading, rather than construction. Today, several hydropower plants are being constructed, one of them the large-scale Upper Tamakoshi. The progress coming from this factor is increased by domestic funding avoiding problems of depletion of foreign currency reserves. Further, domestic projects enhance capacity and skills around project construction within Nepal. This is also a benefit for future progress. A roadblock for domestic private sector however, seems to be that it in general only has the ability to fund medium-sized Run-of-River plants. That is because they cannot acquire the equity needed to cover the risks related to larger-scale or reservoir hydropower projects. This is also related to environmental and natural risks in Nepal posing challenges for hydropower. Nepal does not need more RoR-projects at this stage, firstly because the state power utility NEA cannot afford to pay for all the PPAs in this already full quota unless they find a market to sell the power to. Secondly because Nepal now rather needs storage projects to balance the energy grid.

International finance institutions, with the World Bank in front, have also been important to hydropower development in terms of loans and in their work with expanding Nepal's

transmission system. But, as access to new sources of funding has come, their importance now lies in their strong influence on Nepalese regulation, planning and unbundling of NEA. The main influence comes in the form of policy credits, where they will provide funding to the state if they implement the recommendations from the World Bank. It could be argued that this influence and push to liberalise the sector has led to a limitation of Nepal's policy space to follow and independent energy pathway. On the other hand, NEA still holds considerable power within the Nepalese energy system. Thus, Nepalese autonomy may be strongly influenced by other factors than neoliberalist policies imposed by international finance institutions.

Bilateral aid partners have moved away from financial support to large-scale electricity generation projects in Nepal, but have been influential in capacity-building in the electricity sector. Today their influence is visible in their focus on expanding the Nepalese transmission system, which is also being done by the IFIs. As transmission and distribution is a technical, and perhaps financial roadblock for Nepal today the aid partner's influence can thus be seen as contributing to progress. On the other hand, these aid partners are facilitating for the private sector through their projects, which may also be seen as influence of Nepal's policy space.

A factor that might be considered as a larger limitation on Nepal's policy space today, compared to influence from the IFIs and bilateral aid partners, is geopolitics from India. Nepal's weak position in relation to India was shown by findings on how energy crises can erupt in Nepal if import from India is disrupted. Furthermore, it showed how increasing import from India in turn can solve energy crises in Nepal. Due to a border dispute, India is trying to block Chinese influence. This limits progress in Nepal's electricity development as it makes it hard for Nepal to follow their strategy of exporting electricity surplus to India. Furthermore, Nepal's recent wet-season surplus has weakened their negotiation position in relation to India, as they will be at a loss if they cannot find a market for their power. This also relates back to economic factors, as Chinese and Indian FDI are two of the most important sources of funding for hydropower projects today. Though Chinese companies are willing investors, the Chinese-financed hydropower projects come to a halt because they will not be able to export power to India. Other FDI-actors are also deterred from entering the Nepalese markets as they will not be able to export to India. One example was Statkraft leaving the large-scale Tamakoshi III project. Indian FDI cannot in general be said to lead to progress either, as the power is often exported directly to India and the profitability for

Nepal becomes smaller than with domestic funding. Another question related to this factor is whether India wants or needs the import from Nepal, where findings pointed to an intent from India's side, as long as it happens on Indian terms. However, several international and Nepalese domestic actors are continuously working to open for more trade between the two countries. They hope Indian international climate change commitments in the future will make India import more from Nepal. That remains to be seen.

Thus, one may say that different sources of financing and the actors behind the sources have been the most important factor when Nepal was in a situation of electricity deficiency. In Nepal's ongoing shift to surplus electricity generation, geopolitics has taken over as the most important factor, as it leads to issues for the state to sell their electricity, and as it deters further investments in hydropower.

Another important and more surprising issue highlighted through findings on geopolitics, is the challenges of raising energy consumption in Nepal. The findings displayed the urgency for Nepal to increase domestic consumption, and how state actors struggle to adapt the system to its new context. Increasing consumption is important for Nepal in a variety of ways. As they are increasingly coming into power surplus, creating a larger domestic market for NEA to sell power to through increased consumption is critical. Without, they will continue to be at a loss in upholding PPAs while the water of the plants is spilled. Furthermore, Nepal will need more investments and hydropower construction if they wish to reach the targets in the current electricity strategy by 2028 and become a net exporter. Until Nepal has either an increased domestic or foreign market, the investments needed to construct all those projects will not come. A larger domestic market could thus make it more attractive to invest in the sector again. Nevertheless, what could be considered more important with increasing domestic consumption than to sell more electricity, relates to the many benefits for the Nepalese population. They are today reliant on energy sources that are either very ineffective and time-consuming to acquire, which creates risks to health, or which are expensive. Increased electricity consumption thus serves a broader purpose than to create progress in the sector itself.

As for the influence of the climate and environment factor on electricity development, my findings were more ambiguous as to its importance relative to the other factors. Literature points to international climate change politics as important for energy policy in developing countries. Nepal's climate change commitments, however, seems to be both conditioned on external financing, and largely merged with their current strategies for increasing electricity

supply. This could be due to other factors being of higher importance for the state. For Nepal the most important role of climate change issues today relates to deterioration of the natural environment in the country, such as the risk of glacial lake outburst floods, along with the natural risk of earthquakes in the region. These risks have led to delays and increased cost of hydropower projects. Moreover, along with the geopolitical factors mentioned above, this has led to an increased focus on energy security and improving the energy mix in Nepal. This new focus might also have given more attention to renewable energy sources such as solar power, which there is an unfilled quota for in country's current energy strategy. Thus, while climate change issues and geopolitical factors pose limits to progress of energy development, they also display how some factors may be pushing the Nepalese electricity provision system to slightly change pathway and adapt. Consequently, one may say that the system is not static, but slowly changing.

Lastly, several state characteristics of Nepal also lead to delays. First, the ambitious strategy of current and previous governments, could be seen as having led to progress through attracting more investments, as was its intention. However, the shift from being in electricity deficiency to surplus has effectively meant there is no longer a market for additional electricity. Thus, the ambitious targets or narratives could be seen as limit to progress today as it has kept focus on additional electricity generation rather than on making a proper plan for what they would do with the surplus electricity. Another limit to progress in electricity development is that ideological differences between political parties lead to conflicts. This sometimes delays ratification of important decisions for electricity development and specific hydropower projects. However, these conflicts may also be regarded as making sure Nepal does not sway too much towards one country or source of financing, and thus see more limits to their policy space. Two aspects of the state which both lead to delays for hydropower projects, were corruption and local contestations. While corruption was only seen as negative and a delaying factor, local contestation was also pointed to as positive in the sense that it ensures that the local population is heard and included in decision making.

In sum, a range of political and economic factors currently delays progress in electricity development in Nepal, and they interrelate in complex ways. Some of the factors create delays on local or project level, such as environmental risks and local conflicts. Other factors create challenges through influence on politics at state level, such as push from powerful international actors and difficult bilateral relations. Some of the factors influence progress on multiple levels, such as the border blockade or the role of domestic private

sector actors. They all, however, reflect the difficult situation Nepal is seeing in their shift from electricity deficiency to surplus.

6.2 Policy recommendations

The quotas for peaking run-of-river and storage hydropower in the current electricity strategy will be difficult to fill due to the many risks they pose. Therefore the Government of Nepal could divert more resources to increasing development of small-scale renewable energy technologies. Smaller renewable projects would lead to a more gradual electrification of the country compared to large-scale hydropower, and thus avoid increasing NEAs deteriorating financial situation. The projects are also faster to build and face lower risks from for example natural disasters. Further, the increasingly sinking price of solar power technology makes such development cheaper than large-scale hydropower. And though this is also an intermittent energy source, it avoids the seasonal variation of RoR-projects.

It seems domestic private sector financing in Nepal is the most beneficial in terms of reaching the state's electricity generation targets, but their participation might be challenged by not having access to sufficient financing for large-scale projects. A recommendation could therefore be for the government to put more effort into facilitating for domestic financing, and less into attracting foreign investments.

Lastly, the issues with local opposition to hydropower projects points to a need of more inclusive energy planning, and more official and established means that local population may have their voices heard. Furthermore, there seems to be a need for more mechanism that ensures the promises of local benefits to people inflicted by projects are kept.

6.3 Transferability

The transferability of this research relates mainly to the contextual factors shaping electricity development, if one considers Nepal as a country working on renewable energy generation and electrification without having the financial resources themselves. What is unique for Nepal is how their geographical position place them in-between two global powers who happens to be in conflict. The influence of India is therefore unique to Nepal. The same goes for the ideological differences between political parties in Nepal. The presence of Chinese

investment is however not unique and may be transferable to other cases, as also seen in the literature used.

Other factors that could be seen as transferable are the influence of international finance institutions, such as push to liberalise sectors. This has also been seen in research on many countries with limited financial resources. For example, how the World Bank utilises policy credits in Nepal might be similar in other aid-dependant states, and should be kept in mind by researchers studying political influence on energy systems. The same goes for natural risks and climate change impacts on energy development in vulnerable states. These are global phenomena and might pose similar challenges elsewhere as they do in terms of the cost and risks around hydropower projects in Nepal. Lastly, National characteristics such as corruption in energy development and local conflicts around large-scale hydropower projects are also not unique to Nepal. For example, findings such as how corruption both deters foreign investors and slows down bureaucratic processes might be visible in other growing markets.

6.4 Reflections on the theories used

The theories used in this thesis were suitable to research Nepalese electricity development in its global context, and to identify factors that play a role. I would therefore like to reflect upon the usefulness of different parts of the theory.

First, socio-technical system literature was useful in this study because of how it helps in understanding energy systems, its components, and processes. For the analysis I found the socio-technical mapping of the energy system to be a relatively straight-forward first step of analysis. It provides a tool for concretely and systematically understanding and displaying the components of the system and how they interact. I believe it would have been challenging to understand the electricity system to the same extent had I only used political economy for my theoretical framework. The literature was also helpful in understanding factors that were more related to how actors work and how processes maintain and shape the Nepalese "regime", compared to some of the literature on political economy. However, the challenge with this body of theory is that most of the literature I found was about socio-technical *transitions* through the growth of a niche. Some of these descriptions of a system were not so relevant for my case. This sometimes made it more challenging to use and adapt the literature to my framework.

Political economy on the other hand, is useful for expanding the understanding of the factors placed under the perhaps generic and wide term "socio-technical landscape" from the socio-technical systems and transitions literature. In my opinion the term or category would not have sufficiently addressed what I find to be very important factors surrounding and influencing the energy system, such as geopolitics and climate change issues. The political economy literature was very helpful in this regard. However, I sometimes found this body of literature a bit vague, wide or hard to define. For example, many authors claim to 'take a political economy perspective' on energy systems. Though I agree that the perspective is useful, finding a clearer account of what political economy is and how it can be applied would have made it easier for me to create my framework for analysis.

This way, socio-technical system literature is a good match with political economy, because the first provides quite specific and straightforward descriptions and frames, though that might make it less applicable to all kinds of energy systems. The latter is broad and more of a perspective than a concrete theory, which made it harder to put together, but also more adaptable to my case.

6.5 Implications for future research

In the system mapping I described solar power as an emerging system or niche in Nepal. An interesting topic for future research could be to study solar power or other small-scale renewable technologies in Nepal from a transition perspective. Interesting questions could be around AEPC's role as both a state and a niche actor, or how to engage more Nepalese private sector actors in small-scale renewables. Further, more research is needed on how renewable energy development for countries with limited financial resources may be conducted in a just and inclusive way. This is also relevant for Nepal. This becomes more important considering the increasing global push for energy to come from renewable sources. Socio-technical system literature could contribute to such research.

As the importance of climate change issues and international climate change agreements were ambiguous both in the political economy literature and in this analysis, future research should address the influence of climate change related factors on energy development more specifically. Further, answers to whether India actually wants or needs to import electricity from their neighbours were ambiguous in this thesis. This points to a need for studies that focus more on understanding energy politics within India and what kinds of factors

influence them. An interesting topic of research could for example be on whether climate change agreements may open for more energy import in India. A political economy perspective could be important in such research.

The FDI-section of this thesis brought to light Nepal's problems with their foreign currency reserves, as they are dependent on remittance. And interesting topic of research would therefore be how the Covid-19 pandemic has influenced their financial situation, as it seems to have stopped a great deal of remittance. This could also be an interesting topic for other countries dependent on remittance. Lastly, an important and perhaps surprising find in this thesis relates to the challenges of raising electricity consumption in Nepal. How this work may be improved was not directly addressed in this thesis, but would be an interesting topic of research.

Bibliography

ADB. (2017). *NEPAL ENERGY SECTOR ASSESSMENT, STRATEGY, AND ROAD MAP*. Asian Development Bank. https://www.adb.org/publications/nepal-energy-strategy-roadmap

AEPC. (2022). *Introduction.* Alternative Energy Promotion Centre. Retrieved May 7 from https://www.aepc.gov.np/

Agrawala, S., Raksakulthai, V., Aalst, M. v., Larsen, P., Smith, J., & Reynold, J. (2003). *DEVELOPMENT AND CLIMATE CHANGE IN NEPAL: FOCUS ON WATER RESOURCES AND HYDROPOWER* (COM/ENV/EPOC/DCD/DAC(2003)1/FINAL). OECD

Amatya, V. B., Sharma, P., Shrestha, M., Bimal, Regmi, R., Gentle, P., Manandhar, M. D., & Ghimire, P. (2019). *Policy options to inform mandates of renewable energy agencies in federal context* (Position Paper for Renewable Energy Sector Development Functions, Implementation Modality and Institutional Reforms, Issue). Oxford Policy Management Limited

Asdal, K. (2015). What is the issue? The transformative capacity of documents. *Distinktion: Scandinavian Journal of Social Theory*, *16*(1), 74-90. https://doi.org/10.1080/1600910X.2015.1022194

Bailey, C., White, C., & Pain, R. (1998). Evaluating qualitative research: dealing with the tension between 'science' and 'creativity'. *Area*, *31*(2), 169-183.

Baxter, J. (2016). Case Studies in Qualitative Research. In I. Hay (Ed.), *Qualitative Research Methods in Human Geography*. Oxford University Press.

Bhatt, R. P. (2017). Hydropower Development in Nepal - Climate Change, Impacts and Implications. In B. I. Ismail (Ed.), *Renewable Hydropower Technologies*. IntechOpen. https://doi.org/10.5772/63684

Blaikie, N. (2007). *Approaches to Social Enquiry* (2nd ed.). Polity Press.

Blondeel, M., Bradshaw, M. J., Bridge, G., & Kuzemko, C. (2021). The geopolitics of energy system transformation: A review. *Geography Compass*, *15*, 1-22. https://doi.org/DOI: 10.1111/gec3.12580

Bradshaw, M. J. (2009). The Geopolitics of Global Energy Security. *Geography Compass*, *3*(5), 1920-1937. https://doi.org/10.1111/j.1749-8198.2009.00280.x

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Bridge, G., Bouzarovski, S., Bradshaw, M., & Eyre, N. (2013). Geographies of energy transition: Space, place and the low-carbon economy. *Energy Policy*, *53*, 331-340. https://doi.org/https://doi.org/10.1016/j.enpol.2012.10.066

Bridge, G., & Gailing, L. (2020). New energy spaces: Towards a geographical political economy of energy transition. *EPA: Economy and Space*, *52*(6), 1037–1050. https://doi.org/10.1177/0308518X20939570

Bridge, G., Özkaynak, B., & Turhan, E. (2018). Energy infrastructure and the fate of the nation: Introduction to special issue. *Energy Research and Social Science, 41*, 1-11. https://doi.org/https://doi.org/10.1016/j.erss.2018.04.029

Brusa-Pasque, B. (2021, April 7). *HYDROELECTRICITY: ENVIRONMENTAL AND SOCIETAL IMPACTS*. Encyclopédie de l'énergie. https://www.encyclopedie-energie.org/en/hydroelectricity-environmental-societal-impacts/

Butchers, J., Williamson, S., & Booker, J. (2021). Micro-Hydropower in Nepal: Analysing the Project Process to Understand Drivers that Strengthen and Weaken Sustainability. *Sustainability*, *13*(1582), 1-16. https://doi.org/https://doi.org/10.3390/su13031582

Byrne, R., Onsongo, E., Onjala, B., Todd, J. F., Chengo, V., Ockwell, D., & Atela, J. (2020). *Electric cooking in Tanzania: an actor-network map and analysis of a nascent socio-technical innovation system*. Modern Energy Cooking Services (MECS)

CEA. (2021) PROCEDURE FOR APPROVAL AND FACILITATING IMPORT/EXPORT (CROSS BORDER) OF ELECTRICITY BY THE DESIGNATED AUTHORITY (2021). Central Electricity Authority, Ministry of Power, Government of India. Import/ Export (Cross Border) of Electricity - Central Electricity Authority (cea.nic.in)

Cherp, A., Vinichenko, V., Jewell, J., Brutschin, E., & Sovacool, B. (2018). Integrating techno-economic, socio-technical and political perspectives on national energy transitions: A meta-theoretical framework. *Energy Research and Social Science*, *37*, 175-190. https://doi.org/http://dx.doi.org/10.1016/j.erss.2017.09.015

Cope, M. (2016). Organising and Analysing Qualitative Data. In I. Hay (Ed.), *Qualitative Research Methods in Human Geography*. Oxford University Press.

Dhungana, H., & Maskey, G. (2019). Hydropower Policy and Site-Level Contestation under the Political Transition: Challenges for Ending the Power Cut in Nepal. *Journal of Forest and Natural Resource Management*, *1*(1), 1-24.

Dixit, A., & Gyawali, D. (2010). Nepal's Constructive Dialogue on Dams and Development. *Water Alternatives*, *3*(2), 106-123.

DOED. (2022a). *About Us*. Departement of Electricity Development Retrieved May 5 from https://www.doed.gov.np/pages/about-us

DOED. (2022b, April 15th 2022). *Power Plants :: Hydro (More than 1MW)*. Departement of Electricity Development. https://www.doed.gov.np/license/54

DOED. (2022c, April 15, 2022). *Power Plants :: Solar*. Departement of Electricity Development. https://www.doed.gov.np/license/56

DOED. (2022d, April 15th 2022). *Survey License :: Hydro (in IBN)*. Departement of Electricity Development. https://www.doed.gov.np/license/64

DOED. (2022e, April 15th, 2022). *Survey License :: Hydro (More than 1MW)*. Departement of Electricity Development. https://www.doed.gov.np/license/13

DOED. (2022f, April 15th). *Survey License :: Solar*. Departement of Electricity Development. https://www.doed.gov.np/license/15

Dowling, R. (2016). Power, Subjectivity, and Ethics in Qualitative Research. In I. Hay (Ed.), *Qualitative Research Methods in Human Geography* (4th ed.). Oxford University Press.

DT. (2004, February 10th). *Norconsult wins first untied NORAD hydropower tender*. Development Today. https://www.development-today.com/archive/2004/dt-2/1646

Dunn, K. (2016). Interviewing. In I. Hay (Ed.), *Qualitative Research Methods in Human Geography* (4th ed.). Oxford University Press.

EFN. (2021, May 11th). *ELECTRICITY PRODUCTION*. Energy Facts Norway. https://energifaktanorge.no/en/norsk-energiforsyning/kraftproduksjon/#:~:text=At%20the%20end%20of%202020,production%20was%20153%2C2%20TWh.&text=energy%20supply%20system-,Norway%20has%20the%20highest%20share%20of%20electricity%20produced%20from%20renewable,emissions%20from%20the%20power%20sector

Ellis-Petersen, H. (2021, November 14th). *India criticised over coal at Cop26 – but real villain was climate injustice.* The Guardian. https://www.theguardian.com/environment/2021/nov/14/india-criticised-over-coal-at-cop26-but-real-villain-was-climate-injustice

ESCAP, U. (2021). *Energy Transition Pathways for the 2030 Agenda: SDG7 Roadmap for Nepal*. Retrieved May 4th from https://www.unescap.org/kp/2021/energy-transition-pathways-2030-agenda-sdg7-roadmap-nepal#:~:text=Based%20on%20this%20progress%2C%20it,Status%20and%20Roadmap%202016%2D2030

Geels, F. W. (2004). From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory. *Research Policy, 33,* 897–920. https://doi.org/10.1016/j.respol.2004.01.015

Geels, F. W. (2011). The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions, 1,* 24-40. https://doi.org/10.1016/j.eist.2011.02.002

Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy, 36,* 399–417. https://doi.org/10.1016/j.respol.2007.01.003

George, A. L., & Bennett, A. (2005). *Case Studies and Theory Development in the Social Sciences*. Belfer Center for Science and International Affairs.

Giri, A. (2021, August 27th). *'Stability', Nepal's political parties said. And then they ruined the idea*. The Kathmandu Post. https://kathmandupost.com/politics/2021/08/27/stability-nepal-s-political-parties-said-and-then-they-ruined-the-idea

Goldman, R. (2020, September 8th). *India-China Border Dispute: A Conflict Explained*. The New York Times. https://www.nytimes.com/2020/06/17/world/asia/india-china-border-clashes.html

Goldthaug, A., Keating, M. F., & Kuzemko, C. (Eds.). (2018). *Handbook of the International Political Economy of Energy and Natural Resources*. Edward Elgar Publishing Limited.

GON. (1992). *ELECTRICITY ACT, 2049 (1992)*. Government of Nepal. https://www.moewri.gov.np/pages/act-and-regulations

Graaf, T. V. D., & Sovacool, B. K. (2020). *Global Energy Politics*. Polity Press.

Graaf, T. V. d., Sovacool, B. K., Ghosh, A., Kern, F., & Klare, M. T. (2016). States, Markets, and Institutions: Integrating International Political Economy and Global Energy Politics In T. V. d. Graaf, B. K. Sovacool, A. Ghosh, F. Kern, & M. T. Klare (Eds.), *The Palgrave Handbook of the International Political Economy of Energy* Palgrave Macmillan. https://doi.org/10.1057/978-1-137-55631-8

Gurung, A., Ghimeray, A. K., & Hassan, S. H. A. (2012). The prospects of renewable energy technologies for rural electrification: A review from Nepal. *Energy Policy, 40*, 374-380. https://doi.org/10.1016/j.enpol.2011.10.022

Hancock, K. J., & Sovacool, B. K. (2018). International Political Economy and Renewable Energy: Hydroelectric Power and the Resource Curse. *International Studies Review, 20*, 615–632. https://doi.org/doi:10.1093/isr/vix058

Hatlebakk, M. (2017). *Nepal: A Political Economy Analysis*. Norwegian Institute of International Affairs.

Heringtona, M. J., & Malakar, Y. (2016). Who is energy poor? Revisiting energy (in)security in the case of Nepal. *Energy Research & Social Science, 21*, 49-53. https://doi.org/http://dx.doi.org/10.1016/j.erss.2016.06.025

IBN. (2022). *What is IBN?* Retrieved May 5th 2022 from https://ibn.gov.np/what-ibn-does/

ICIMOD. (2019, May 16th). *When the levee breaks: Reducing GLOF risks through dam breach modelling*. https://www.icimod.org/when-the-levee-breaks-reducing-glof-risks-through-dam-breach-modelling/

IHA. (2019, May). *COUNTRY PROFILE: Nepal*. International Hydropower Association. https://www.hydropower.org/country-profiles/nepal

IHA. (2022). *Types of hydropower*. International Hydropower Association. Retrieved May 4 2022 from https://www.hydropower.org/iha/discover-types-of-hydropower

Johnson, J. T., & Madge, C. (2016). Empowering Methodologies: Feminist Indigenous Approaches. In I. Hay (Ed.), *Qualitative Research Methods in Human Geography* (Vol. 4th). Oxford University Press.

Jordhus-Lier, D., & Stokke, K. (2017). Samfunnsgeografiske kjernebegreper. In D. Jordhus-Lier & K. Stokke (Eds.), *Samfunnsgeografi: En innføring*. Cappelen Damm Akademisk.

Järvinen, M., & Mik-Meyer, N. (2020). Analysing qualitative data in social science. In M. Järvinen & N. Mik-Meyer (Eds.), *Qualitative Analysis: Eight Approaches for the Social Sciences*. Sage Publications.

Keating, M. F. (2018). International political economy and the global governance of hydroelectric dams. In A. Goldthaug, M. F. Keating, & C. Kuzemko (Eds.), *Handbook of the International Political Economy of Energy and Natural Resources* (pp. 199-213). Edward Elgar Publishing.

Kuzemko, C. (2019). Re-scaling IPE: local government, sustainable energy and change. *Review of International Political Economy*, *26*(1), 80–103. https://doi.org/https://doi.org/10.1080/09692290.2018.1527239

Kuzemko, C., Keating, M. F., & Goldthaug, A. (2018). Nexus-thinking in international political economy: what energy and natural resource scholarship can offer international political economy. In A. Goldthaug, M. F. Keating, & C. Kuzemko (Eds.), *Handbook of the international political economy of energy and natural resource*. Edward Elgar Publishing Limited.

Lawhon, M., & Murphy, J. T. (2011). Socio-technical regimes and sustainability transitions: Insights from political ecology. *Progress in Human Geography*, *36*(3), 354–378. https://doi.org/10.1177/0309132511427960

Lord, A., & Rest, M. (2021). Nepal's Water, the People's Investment? Hydropolitical Volumes and Speculative Refrains. In T. Loloum, S. Abram, & N. Ortar (Eds.), *ETHNOGRAPHIES OF POWER: A Political Anthropology of Energy* (Vol. 42). Berghahn Books.

MacKinnon, D., Dawley, S., Pike, A., & Cumbers, A. (2019). Rethinking Path Creation: A Geographical Political Economy Approach. *Economic Geography*, *95*(2), 113-135. https://doi.org/10.1080/00130095.2018.1498294

MOEWRI. (2022). *Home*. Ministry of Energy, Water Resources and Irrigation. Retrieved May 19 2022 from https://moewri.gov.np/

Molden, D. J., Vaidya, R. A., Shrestha, A. B., Rasul, G., & Shrestha, M. S. (2014). Water infrastructure for the Hindu Kush Himalayas. *International Journal of Water Resources Development*, *30*(1), 60-77. http://dx.doi.org/10.1080/07900627.2013.859044

MOP. (2018) *Guidelines for Import / Export (Cross Border) of Electricity - 2018, 8 (2018)*. Ministry of Power, Government of India https://powermin.gov.in/en/content/guidelines-importexport-cross-border-electricity-2018

Movik, S., & Allouche, J. (2020). States of power: Energy imaginaries and transnational assemblages in Norway, Nepal and Tanzania. *Energy Research & Social Science, 67* (101548), p.1-11.

Nepal, R. (2012). Roles and potentials of renewable energy in less-developed economies: The case of Nepal. *Renewable and Sustainable Energy Reviews*, *16*, 2200–2206. https://doi.org/10.1016/j.rser.2012.01.047

Newell, P. (2014). Environment. In P. Burnell, L. Rakner, & V. Randall (Eds.), *Politics in the Developing World* (Fourth ed.). Oxford Universtiy Press.

Newell, P. (2021). *POWER SHIFT*. Cambridge University Press. https://doi.org/10.1017/9781108966184

Newell, P., & Phillips, J. (2016). Neoliberal energy transitions in the South: Kenyan experiences. *Geoforum*, *74*, 39-48. https://doi.org/http://dx.doi.org/10.1016/j.geoforum.2016.05.009

NOC. (2022). *Import And Sales*. Nepal Oil Corporation Limited. Retrieved April 28th from http://noc.org.np/import

NPC. (2020). *The Fifteenth Plan: (Fiscal Year 2019/20 – 2023/24)*. Nepal Planning Commission, Government of Nepal. https://npc.gov.np/en/category/periodic_plans

NPC. (2022). *Introduction and History*. National Planning Commission. Retrieved May 8th from https://npc.gov.np/en/page/introduction_history

Ogino, K., Nakayama, M., & Sasaki, D. (2019). Domestic Socioeconomic Barriers to Hydropower Trading: Evidence from Bhutan and Nepal. *Sustainability 11*(2062), 1-19. https://doi.org/10.3390/su11072062

Overland, I. (2019). The geopolitics of renewable energy: Debunking four emerging myths. *Energy Research and Social Science, 49*, 36-40. https://doi.org/https://doi.org/10.1016/j.erss.2018.10.018

Poel, I. V. D. (2000). On the Role of Outsiders in Technical Development. *Technology Analysis & Strategic Management*, *12*(3), 383-397. https://doi.org/https://doi.org/10.1080/09537320050130615

Power, M., Newell, P., Baker, L., Bulkeley, H., Kirshner, J., & Smith, A. (2016). The political economy of energy transitions in Mozambique and South Africa: The role of the Rising Powers. *Energy Research and Social Science*, *17*, 10-19. https://doi.org/http://dx.doi.org/10.1016/j.erss.2016.03.007

Pradhan, P. M. S. (2009). Hydropower Development. In D. N. Dhungel & S. B. Pun (Eds.), *The Nepal–India Water Relationship: Challenges*. Springer.

Prasain, S., & Shrestha, P. M. (2021, July 6th). Nepal starts operating its largest hydropower station. *The Kathmandu Post*. https://kathmandupost.com/national/2021/07/06/nepal-starts-operating-its-largest-hydropower-station

Ramos-Mejia, M., Franco-Garcia, M., & Jauregui-Becker, J. M. (2018). Sustainability transitions in the developing world: Challenges of socio-technical transformations unfolding in contexts of poverty. *Environmental Science and Policy, 84,* 217-223. https://doi.org/10.1016/j.envsci.2017.03.010

Republica. (2016, July 19th). *MoF reimburses Rs 3.96b to NEA.* Republica. https://myrepublica.nagariknetwork.com/news/mof-reimburses-rs-3-96b-to-nea/

Republica. (2022, January 5th). *Nepal imports 367 MW of electricity from India, despite govt claim of energy surplus in the country*. Republica. https://myrepublica.nagariknetwork.com/news/nepal-imports-367-mw-of-electricity-from-india-despite-govt-claim-of-energy-surplus-in-the-country/#:~:text=06%3A04%20PM-,Nepal%20imports%20367%20MW%20of%20electricity%20from%20India%2C%20despite%20govt,energy%20surplus%20in%20the%20country

Rijal, P. (2019, July 27). *Chinese, Nepali firms sign deal to develop Tamakoshi 3 scheme.* The Kathmandu Post. https://kathmandupost.com/money/2019/07/27/chinese-nepali-firms-sign-deal-to-develop-tamakoshi-3-scheme

Robinson, I. (2015). Area and International Studies: Political Economy. In J. D. Wright (Ed.), *International Encyclopedia of the Social & Behavioral Sciences* (2nd ed., Vol. 1, pp. 938-942): Elsevier.

Rosser, S. V. (2008). Gender Inclusion, Contextual Values, and Strong Objectivity: Emergent Feminist Methods for Research in the Sciences. In S. N. Hesse-Biber & P. Leavy (Eds.), *Handbook of Emergent Methods.* The Guilford Press.

Roy, T. (2017). *The Economy of South Asia: From 1950 to the Present.* Palgrave Macmillan. https://doi.org/10.1007/978-3-319-54720-6

SAPDC. (n.d.). *Foundation Stone of SJVN's 900 MW Arun-3 Hydro Electric Project jointly laid by Hon'ble Prime Minister of India & Hon'ble Prime Minister of Nepal*. SJVN Arun-3 Power Development Company Pvt. Ltd. Retrieved April 13th from https://www.sapdc.com.np/page/foundation-stone-of-sjvns-900-mw-arun-3-hydro-electric-project-jointly-laid-by-honble-prime-minister-of-india-honble-prime-minister-of-nepal

Sharma, K., & Bhattarai, B. P. (2019). Foreign Aid and Export Performance in a Landlocked Country: Development Lessons from Nepal. In K. Jayanthakumaran, N. Shukla, C. Harvie, & O. Erdenetsogt (Eds.), *Trade Logistics in Landlocked and Resource Cursed Asian Countries*. Palgrave Macmillan. https://doi.org/https://doi.org/10.1007/978-981-13-6814-1_8

Sharma, R. H., & Awal, R. (2013). Hydropower development in Nepal. *Renewable & sustainable energy reviews, 21,* 684-693. https://doi.org/10.1016/j.rser.2013.01.013

Shrestha, P. M. (2021a, November 3rd). *Delhi opens door for Nepal to sell power in India's energy exchange market.* The Kathmandu Post.

https://kathmandupost.com/national/2021/11/02/delhi-opens-door-for-nepal-to-sell-electricity-in-india-s-energy-exchange-market

Shrestha, P. M. (2021b, August 10th). *Once power-starved, Nepal now aims to export electricity*. The Kathmandu Post. https://kathmandupost.com/money/2021/08/10/once-power-starved-nepal-now-aims-to-export-electricity#:~:text=Nepal%2C%20currently%2C%20has%20an%20installed,currently%20stands%20at%201%2C550MW.

Shrestha, P. M. (2022a, February 23rd). *Nepal presents fresh list of power projects to India for exporting electricity during monsoon.* The Katmandu Post. https://kathmandupost.com/national/2022/02/23/nepal-presents-fresh-list-of-power-projects-to-india-for-exporting-electricity-during-monsoon

Shrestha, P. M. (2022b, January 20th). *No China involvement is India's caveat for buying power from Nepali plants*. The Kathmandu Post. https://kathmandupost.com/money/2022/01/20/no-china-involvement-is-india-s-caveat-for-buying-power-from-nepali-plants

Siciliano, G., Urban, F., Tan-Mullins, M., & Mohan, G. (2018). Large dams, energy justice and the divergence between international, national and local developmental needs and priorities in the global South. *Energy Research and Social Science*, *41*, 199-209. https://doi.org/https://doi.org/10.1016/j.erss.2018.03.029

Sikor, T., Satyal, P., Dhungana, H., & Maskey, G. (2019). Brokering justice: global indigenous rights and struggles over hydropower in Nepal. *CANADIAN JOURNAL OF DEVELOPMENT STUDIES*, *40*(3), 311–329. https://doi.org/https://doi.org/10.1080/02255189.2018.1540344

Singh, R. P., Nachtnebel, H. P., & Komendantova, N. (2020). Deployment of Hydropower in Nepal: Multiple Stakeholders' Perspectives. *Sustainability*, *12*, 1-17. https://doi.org/10.3390/su12166312

Smith, K. E. (2006). Problematising power relations in 'elite' interviews. *Geoforum*, *37*, 643-653. https://doi.org/doi:10.1016/j.geoforum.2005.11.002

Sovacool, B. K., Bambawale, M. J., Gippner, O., & Dhakal, S. (2011). Electrification in the Mountain Kingdom: The implications of the Nepal Power Development Project (NPDP). *Energy for Sustainable Development*, *15*, 254-265. https://doi.org/10.1016/j.esd.2011.06.005

Sovacool, B. K., Dhakal, S., Gippner, O., & Bambawale, M. J. (2011). Halting hydro: A review of the socio-technical barriers to hydroelectric power plants in Nepal. *Energy*, *36*, 3468-3476. https://doi.org/10.1016/j.energy.2011.03.051

Statkraft. (2016, January 13th). *Statkraft to discontinue development of TA3 in Nepal.* https://www.statkraft.com/newsroom/news-and-stories/archive/2016/statkraft-to-discontinue-development-of-ta3/

Stirling, A. (2014). Transforming power: Social science and the politics of energy choices. *Energy Research and Social Science, 1*, 83-95. https://doi.org/http://dx.doi.org/10.1016/j.erss.2014.02.001

Stratford, E., & Bradshaw, M. (2016). Qualitative Research Design and Rigour. In I. Hay (Ed.), *Qualitative Research Methods in Human Geography*. Oxford University Press.

Subedi, B. (2017, May 28th). *160 MW power deal signed: NEA*. The Kathmandu Post. https://kathmandupost.com/money/2017/05/28/160-mw-power-deal-signed-nea

SAARC. (2020a, July 12th). *About SAARC*. South Asian Association of Regional Cooperation. https://www.saarc-sec.org/index.php/about-saarc/about-saarc

SAARC. (2020b). *Energy Transport Science And Technology*. South Asian Association of Regional Cooperation. Retrieved May 7th from https://www.saarc-sec.org/index.php/areas-of-cooperation/energy-transport-science-technology

TKP. (2016, December 13th). *'Power trading guideline does not debar pvt firms'*. The Kathmandu Post. https://kathmandupost.com/money/2016/12/13/power-trading-guideline-does-not-debar-pvt-firms

TKP. (2017, January 10th, 2017). *Energy Ministry fixes power purchase rates*. The Kathmandu Post. https://kathmandupost.com/money/2017/01/10/energy-ministry-fixes-power-purchase-rates

Trace, S. (2019). *Electricity in Nepal* (EEG Energy Insight). Oxford Policy Management. EEG Energy Insight - Electricity in Nepal | EEG (energyeconomicgrowth.org)

UiO. (2022, March 14th). *Data management at ISS*. Retrieved April 25th from https://www.sv.uio.no/studier/master/iss/Datahandtering/data-management-at-iss.html

Ulsrud, K. (2004). *Solenergi i utviklingsland: Hvilke faktorer hemmer og fremmer bruk av solenergi i India?* [Masteroppgave, University of Oslo].

Ulsrud, K. (2015). *Village-level solar power in practice: Transfer of socio-technical innovations between India and Kenya*. [Doktorgradsachandling, University of Oslo].

Ulsrud, K. (2017). Grønne innovasjoner i sosio-tekniske systemer. In D. Jordhus-Lier & K. Stokke (Eds.), *Samfunnsgeografiske kjernebegreper: En innføring*. Cappelen Damm Akademisk.

UNDP. (No date). *Nepal: In depth*. United Nationas Development Programme. Retrieved May 2 from https://www.np.undp.org/content/nepal/en/home/energy-environment-climate-and-disaster-risk-management/in-depth.html

UTKHPL. (2022). *Introduction*. Upper Tamakoshi Hydropower Limited. Retrieved 2022 from https://utkhpl.org.np/introduction/

Vindegg, M. (2020). *Power to the people: The energy anthropology of a Nepali Town* (Publication Number 845) [Doktorgradsachandling, University of Oslo].

Virtanen, M. (2006). Foreign Direct Investment and Hydropower in Lao PDR: The Theun-Hinboun Hydropower Project. *Corporate Social Responsibility and Environmental Management, 13*, 183–193. https://doi.org/DOI:10.1002/csr.095

Wahid, S. M., Mukherji, A., & Shrestha, A. (2016). Climate Change Adaptation, Water Infrastructure Development, and Responsive Governance in the Himalayas: The Case Study of Nepal's Koshi River Basin. In C. Tortajada (Ed.), *Increasing Resilience to Climate Variability and Change: The Roles of Infrastructure and Governance in the Context of Adaptation*. Springer. https://doi.org/10.1007/978-981-10-1914-2

WB. (2016). *Powering Recovery* (Nepal development update). World Bank. https://openknowledge.worldbank.org/handle/10986/25273?locale-attribute=en

WB. (2018). *INTERNATIONAL DEVELOPMENT ASSOCIATION: PROGRAM DOCUMENT FOR A PROPOSED DEVELOPMENT POLICY CREDIT IN THE AMOUNT OF SDR 71.2 MILLION (US$100 MILLION EQUIVALENT) TO NEPAL FOR A FIRST PROGRAMMATIC ENERGY SECTOR DEVELOPMENT POLICY CREDIT* (No. 126593-NP). (Energy and Extractives Global Practice: South Asia Region Issue).

WECS. (2013). *National Energy Strategy of Nepal*. Water and Energy Commission Secretariat, Government of Nepal. https://policy.asiapacificenergy.org/sites/default/files/National%20Energy%20Strategy%20of%20Nepal%202013%20%28EN%29.pdf

Winchester, H. P. M., & Rofe, M. W. (2016). Qualitative Research and Its Place in Human Geography. In I. Hay (Ed.), *Qualitative Research Methods in Human Geography*. Oxford University Press.

Yadoo, A., & Cruickshank, H. (2012). The role for low carbon electrification technologies in poverty reduction and climate change strategies: A focus on renewable energy mini-grids with case studies in Nepal, Peru and Kenya. *Energy Policy*, *42*, 591–602. https://doi.org/10.1016/j.enpol.2011.12.029

Attachment 1: List of informants

Informant 1: Nepalese consultant for small-scale renewable energy solutions in a private firm. Interview on Zoom November 24th, 2021.

Informant 2: Nepalese researcher on local impacts and environmental justice of hydropower projects, from Kathmandu University. Interview on Zoom November 25th, 2021.

Informant 3: ERC Commissioner working with planning and monitoring for the Electricity Regulatory Commission. Interview on Zoom December 12th, 2021.

Informant 4a and 4b: Energy Advisor and Counsellor from a European embassy. Interview on Teams January 19th, 2022. (*2 informants in the same interview).*

Informant 5: Climate Advisor to a European embassy, formerly worked in environmental NGO. Interview on Zoom January 24th, 2022.

Informant 6: Norwegian consultant involved in the Upper Tamakoshi Project. Interview on Zoom February 8th, 2022.

Informant 7: Divisional director in SAARC. Interview on Zoom, February 10th, 2022.

Informant 8: Research fellow in SAARC. Interview on Zoom, February 10th, 2022.

Informant 9: Norad Advisor. Interview by phone call February 17th, 2022.

Informant 10: Statkraft employee who has been involved in several projects in Nepal. Interview on Teams February 23rd, 2022.

Informant 11: IBN consultant on renewable and alternative energy for Investment Board of Nepal. Interview on Zoom February 25th, 2022.

Informant 12: AEPC officer. Interview on Zoom March 2nd, 2022.

Informant 13: WB Specialist, for World Bank Nepal. Interview on Teams March 7th, 2022.

Informant 14: IPPAN member, Executive Committee. Interview on Zoom March 22nd, 2022.

Informant 15: Cicero Researcher on climate policies in India. E-mail interview and communication March 31st and April 6th, 2022.

Informant 16: NEA employee from the System Planning Department. Interview on Zoom March 31st, 2022.

Attachment 2: Simplified interview guide

1. Introduction
    a. Information about the research project and why I contacted the informant
    b. Recording
    c. Ask the informant to contact me if any concerns regarding participation
2. Background
    a. Participant's work with the topic, currently or previously
    b. Work of institution/company, involvement in hydropower projects
3. Energy strategy of Nepal
    a. About the current energy strategy of Nepal.
    b. Have the focus/goals of the energy strategy changed over time?
        i. Has it changed: in relation to export; due to climate change issues like the Paris agreement; in relation to modes of financing? How?
    c. Did this and that historical event have any influence on the strategy?
    d. What is needed to reach the strategy?
4. Energy system mapping
    a. Who are important actors/institutions/companies in the energy sector?
    b. Which public documents are important?
    c. What kind of energy technologies are in use in Nepal and why?
5. About the hydropower plants as cases
    a. How did the informants/institution/company get involved with the project?
    b. How was the project financed?
    c. What are advantages/disadvantages with this type of financing?
    d. What other options are there for financing? What are advantages/disadvantages with those types?
    e. How did situation/event X (e.g. local resistance to project, risk of GLOFs, civil war etc.) influence project development?
    f. Why was the project delayed?
    g. What are the roadblocks/prospect for the project to export to India?
6. Closing questions
    a. Is there anything you would like to highlight or add from our talk?
    b. Do you have the contact information of someone relevant in institution X?
    c. Can I contact you again later if I need to follow up on something?