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A study of Vietnam's energy transition pathway to low-carbon development

Energy transition from the Vietnamese perspective

Master's thesis in Globalisation and Sustainable Development

Supervisor: Alexander Myklebust

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Abstract

This thesis investigates what an energy transition looks like from the Vietnamese perspective using the meta-theoretical three perspectives framework on national energy transitions by Cherp et al (2018). Using this framework this thesis give overview of important techno-economic, - socio-technical, - and political factors influencing the energy transition pathway as highlighted by Vietnam. This thesis uses the method of textual analysis of Vietnamese policy and strategy documents. Vietnam is currently dependent on fossil fuels and is experiencing increasing import dependence as domestic supply cannot keep up with the increasing energy demands in the rapidly growing economy. Vietnam has great potential for both solar- and wind power and has seen success with both solar- and wind power development. But the power grid for integrating and transmitting, is incomplete and experiencing bottlenecks, and is currently not able to handle the level of renewable power generated. The energy system has strong state-owned enterprises in fossil fuel and the power grid, functioning as the main actors.

Vietnam's recent success with solar and wind, the net-zero emissions target by 2050 and the decision to join the Global Coal to Clean Power Transition Statement are positives steps in the energy transition pathway. Vietnam is balancing a growing economy and increasing energy demands with the need for carbon mitigation, in a fossil fuel dependent energy system. The findings suggest that energy transition in Vietnam signals energy security. By increasing domestic supply through diversification of the energy mix with renewable energy development, Vietnam can reduce its increasing dependance on imported fossil fuel and particularly coal. Transitioning from fossil fuel to renewable energy for developing Vietnam is occurring alongside energy sector development. Energy transition in Vietnam is both national and global, as Vietnam highlight the need for international support in financing, technology transfer and capacity building.

Foreword

This thesis is written under the supervision of the Department of Geography at the Norwegian University of Science and Technology (NTNU) as part of the Master Programme Globalization and Sustainable Development. First and foremost, I have to thank my supervisor, Postdoctoral Fellow at NTNU Alexander Myklebust. Your feedback and support during this research project have been invaluable.

I also have to thank my very closest friends during this process. Writing a master thesis is stressful and challenging. When life gives you your greatest challenge in the midst of all that, it is comforting and heartwarming to know your friends are always there and can lift you back up. You know who you are! And you are my family!

To my mother, who I miss dearly! This one is for you!

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Acronyms and abbreviations

BAU	Business as Usual
BOT	Build Operate Transfer
CPV	Communist Party of Vietnam
CO2	Carbon Dioxide
COP26	26 th United Nations Climate Change Conference of the Parties
EVN	Vietnam Electricity
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GHG	Greenhouse gas
GIZ	German Agency for International Cooperation
GIZ ESP	GIZ Energy Support Programme
GW	Gigawatts
IPP	Independent Power Producer
INDC	Intended Nationally Determined Contributions
LNG	Liquified Natural Gas
MOIT	Ministry of Industry and Trade
MONRE	Ministry of Natural Resources and Environment
MLP	Multi-Level Perspective
MPI	Ministry of Planning and Investment
MOF	Ministry of Finance of Vietnam
MW	Megawatts
NDC	National Determined Contributions
NEDS	National Energy Development Strategy
NTNU	Norwegian University of Science and Technology
PIPA	Plan for Implementation of the Paris Agreement
PVN	Vietnam Oil and Gas Group
PV	Photovoltaic
PDP	Power Development Plan
REDS	Renewable Energy Development Strategy

R&D	Research and Development
SOE	State-Owned Enterprise
SDG	Sustainable Development Goals
TPES	Total Primary Energy Supply
USD	United States Dollar
Vinacomin	Vietnam National Coal-Mineral Corporation
VEPG	Viet Nam Energy Partnership Group

1. Introduction

Discussions on energy transitions has been increasingly put on the global agenda in recent years. In the *Theme Report on Energy Transition: Towards the Achievement of SDG 7 and Net-Zero Emissions* the United Nations highlight the urgent need of transitioning from a fossil fuel-based energy sector to one based on renewable energy sources in order to meet the goals of the Paris Agreement. The need to combat climate change is the driving force behind energy transitions, as the energy sector is the biggest emitter of greenhouse gases (United Nations , 2021).

Transitioning from fossil fuel-based development to development by largely renewable sources of energy is arguably the most important task on the global agenda.

The energy sector plays a key role in promoting socio-economic development. The importance of energy was highlighted in the first progress report by the United Nations Economic and Social Council on the Sustainable Development Goals from 2016. The report states, “energy is crucial for achieving almost all of the Sustainable Development Goals, from its role in eradicating poverty through advancements in health, education, water supply and industrialization, to combating climate change” (ECOSOC, 2016, p. 11). Vietnam in their rapid and impressive development path has relied heavily on fossil fuels to fuel their development and industrialization as developed economies did before them (World Bank & MPI, 2016). The developing and emerging economy is facing an array of different challenges with climate change vulnerability, energy security and climate change mitigation. Vietnam scores among the top ten most affected countries by extreme weather events in the period from 1999 to 2018 by Global Climate Risk Index 2020 (Eckstein, Kunzel, Schafer, & Wings, 2019). The country has shown their intent to take part in the global efforts to mitigate climate change. Vietnam signed the Paris Agreement in 2016 and submitted, as scheduled, its updated National Determined Contributions (NDC) in 2020 and again in 2022. In their NDC from 2022 Vietnam put fort the target of net-zero emission by 2050 (Socialist Republic of Viet Nam, 2022). As Vietnam strives to mitigate climate change, they also face several challenges in ensuring national energy security. Fuel import dependence is increasing, and fossil fuels are increasingly fueling the country’s development. Predictions suggest a continued increase in fossil fuel development to meet the rapidly increasing energy demands unless Vietnam accelerates its ongoing energy transition (EREA & DEA, 2019; EREA

& DEA, 2022). For Vietnam to reach their net-zero emission target and effectively participate in climate change mitigation they will need to decarbonize energy which means that Vietnam will have to transition from a fossil fuel-based energy system to a low-carbon energy system.

1.1 Background of study

Vietnam's economic development since the Doi Moi (Renovation) economic liberalization reforms introduced in 1986 is impressive (World Bank, 2021). At the time, Vietnam faced an economic crisis and deteriorating living standards which resulted in the Communist Party of Vietnam (CPV) introducing economic reforms. 1986 marked the start of the renovation process from a centrally planned economy to a socialist-oriented market economy (Revilla Diez, 2016). The economic reforms opened the previously closed economy, which resulted in inflows of Foreign Direct Investment (FDI), the emergence of a growing private sector and globalization of business and trade (UNDP, 2021). The reforms significantly transformed economic policy and the role of the state in the economy and reform process is still ongoing (World Bank & MPI, 2016). Despite decades of Vietnam's involvement with and pressure from neoliberal institutions, the state continues to play a significant role in shaping economic development. Vietnam follows the path of state-led development, as seen with many of the region's success stories (Beeson & Pham, 2012). The reform processes propelled the country's current development path and Vietnam transitioned from being one of the world's poorest countries to joining the ranks of lower middle-income nations in 2010 (UNDP, 2021). Gross Domestic Product (GDP) per capita increased nearly threefold between 2002 and 2018 and more than 45 million were lifted out of poverty (World Bank, 2021). In 2021 the CPV announced in the 13th National Party Congress's Resolution that they aspire to join the ranks of developed nations as an industrialized country by 2045 (Viet Nam News, 2021). Vietnam has since the Doi Moi reforms followed an FDI and export-oriented industrialization strategy and this has been key to Vietnam's rapid economic growth (Pham, Hollweg, Mtonya, Winkler, & Nguyen, 2019). Vietnam's economy has since the 1990s been one of the fastest growing economies with an average annual GDP growth of 6 percent, both in the region and globally (EREA & DEA, 2019).

Increased development is followed by both demographic and socio-economic changes. Population is predicted to increase from 96.5 million (2019) to 120 million by 2050. The

emerging middle class at 13 percent of the population is expected to hit 26 percent by 2026. Access to electricity increased from just 14 percent in 1993 to 99 percent in 2016 (World Bank, 2021). Vietnam's substantial economic development since the Doi Moi is presented as a success story, however, the country's rapid economic growth and industrialization has also resulted in an array of environmental stresses threatening future sustainable development (World Bank & MPI, 2016). The energy sector is dependent on fossil fuels, but Vietnam has in recent years seen success with solar and wind (EREA & DEA, 2022). The power sector is responsible for two-thirds of the country's greenhouse gas (GHG) emissions. Vietnam has emerged during the last two decades as the fastest growing per-capita GHG emitter in the world, growing at about 5 percent annually (World Bank, 2021).

In addition to climate change, Vietnam is facing challenges of deforestation and land degradation, loss of biodiversity, air- and water pollution as well the issue of waste (Ortmann, 2017). Climate change is threatening food security. Vietnam's long coastal line and low-lying regions are vulnerable to sea-level rise, precipitation changes, rising temperature, droughts, flooding, and saltwater intrusion. The wetland region of the Mekong Delta is the main agricultural hub, and the region is particularly vulnerable to climate change. Over half of the country's rice production and nearly all rice exports are produced there and a sea-level rise of one meter could potentially inundate nearly 40 percent of the delta (Socialist Republic of Viet Nam, 2011; Socialist Republic of Viet Nam, 2020). An economic overview of the region by the Vietnam Chamber of Commerce and Industry paints a picture of heightened vulnerability. The region accounts for 12.8 percent of GDP and approximately 20 percent of the population. The region is also responsible for 70 percent of fruit production and 65 percent of fishery production (VCCI, 2021).

Vietnam ranked near the bottom of the 2018 Environmental Performance Index in the air pollution category with the score 161 out of 180. The country is expected among the Southeast Asian countries to be the most affected by air pollution the coming decade due to the emissions from coal-fired power plants (Kim, Harish, Kennedy, Jin, & Urpelainen, 2020). In 2019, the capital of Hanoi saw increased air pollution levels, reaching the highest level in five years. Vietnam Electricity (EVN) publicly stated that theirs and other coal-fired power plants are not polluting the city and rejected the allegations made by an environmental activist that coal was at

fault. Stating that their power plants was too far away from the city to be at fault and pointed to the statement by the Hanoi Environmental Protection Department that the increased pollution was due to unfavorable meteorological conditions (Sen, 2019). According to the World Health Organization (2021), approximately 60,000 deaths in Vietnam each year are related to air pollution.

1.2 Problem Statement and research aim

Energy transition is closely linked to the Paris Agreement and the global fight against climate change. The energy sector globally is responsible for two-thirds of total GHG emissions (IEA, 2021B). The growing threat of climate change is pressuring fossil fuel energy systems globally and it is also affecting public policy and technology. Coal was one of the highly debated topics leading up to and during COP26 with an increase in new commitments to phase out coal by countries, international banks, and public finance institutions (UNFCCC, 2021). COP26 set out to assign coal to history, however, at the end of the conference by remarks by India and China the final agreement shifted from using the word phase-out and instead compromised with the wording of phase-down of unabated coal power (UNEP, 2021; Hook, Hodgson, & Pickard, 2021). Despite coal declines in Europe and United States the future of coal is uncertain. Coal remains the second largest primary energy source today. Seven countries today, all located in Asia, account for 70% of global coal consumption and most new coal power projects. China, India, Indonesia, Pakistan, Bangladesh, the Philippines together with Vietnam plays an important role in the future of coal (Alvarez & Arnold, 2020). Vietnam is also located in the highly populous region of Southeast Asia, with rapidly growing economies that are increasingly gaining weight in shaping global economic and energy outlooks (IEA, 2019). Emerging markets and developing economies now account for two thirds of global emissions (IEA, 2021A). This is highlighting the importance of transitioning from fossil fuel to renewable energy in the region in order to combat climate change. This also makes the region an important area to study in the context of energy transition and development.

Vietnam has seen success with scaling up solar in recent years and has become a leader among the ASEAN states in both solar and wind electricity development. In 2019 Vietnam surpassed Thailand with the largest installed capacity of solar and wind. Their total installed solar

photovoltaic (PV) capacity reached 16.500 megawatts (MW) by the end of 2020 (Do, et al., 2021). Furthermore, Vietnam saw an added capacity of 9.296 MW of generating capacity in Solar PV in only one year. This is equivalent to six coal-fired power plants (Broom, 2021). Wind power capacity has also grown significantly with 600 MW capacity added by the end of 2020 ranking Vietnam second in wind power development in the region (Do, et al., 2021). Transitioning from business-as usual fossil fuel development to renewable energy requires strong government support, institutional capacity and favorable market mechanisms to encourage investment (IRENA, 2021). Vietnam strives to fulfill the commitments of the Paris Agreement and has joined the global efforts in mitigating climate change. The recent surge in solar- and wind power and their net-zero emissions target show that Vietnam has set out to transition from fossil fuels to renewable energy. Since Vietnam is in an early stage of energy transition this thesis investigates what that looks like in a developing and emerging economy.

1.3 Research Question

This thesis aims to give an overview of what an energy transition looks like from the Vietnamese perspective. In attempting to do so this thesis uses the three-perspective framework on national energy transitions by Cherp et al (2018) and employs document analysis of Vietnamese policy and strategy documents. Using this framework, the aim is to present an overview of important factors influencing the ongoing energy transition. Furthermore, as transitioning from fossil fuel to renewable energy involves the un-locking of fossil fuel systems, the framework can be used to understand factors that hinders or opens up for Vietnam to break its path dependence of fossil fuels. This thesis is guided by the following research question:

- From the Vietnamese perspective, what are the techno-economic, socio-technical and political factors influencing energy transition in Vietnam?

1.4 Structure of Study

This thesis started by introducing the chosen topic of energy transition in Vietnam. It then gave a brief introduction to Vietnam's development path and its challenges of energy security and climate change vulnerability. Chapter 2 presents the theoretical background using sustainability

transition literature on energy transitions. The methodological approach used is presented in chapter 3. Chapter 4, 5, and 6 present and analyze the findings using the theoretical framework presented in chapter 2. Chapter 7 summarizes the findings and present an overview of important techno-economic, - socio-technical, - and political factors influencing Vietnam's energy transition pathway. In chapter 8 energy transition in Vietnam is discussed in the light of breaking the path dependence of fossil fuel development and discusses Vietnam's situation in the global context of energy transition. The thesis concludes with a brief summary of the main takeaways of this research and presents recommendations for future research.

2. Theoretical Framework for Energy Transition

The way in which societies use energy has changed over the course of history. It is currently changing and will likely continue to change in the future. Energy transition, as stated by the International Renewable Energy Agency, is a pathway to transform the global energy sector from using fossil fuel-based sources to zero-carbon, such as renewable energy. Decarbonization is at the forefront of this energy transition as a tool to mitigate climate change (IRENA, 2021). Such changes or transitions have been vastly studied and from a variety of different academic fields providing different perspectives. This thesis employs sustainability transition literature as the basis for the theoretical framework guiding this thesis. The field of sustainability transition studies “emerged at the intersection of innovation studies, evolutionary economics, science and technology studies, sociology and history of technology” (p. 628) and employs systems thinking (Markard, 2018).

A fundamental transformation of production and consumption patterns is required to tackle the sustainability challenges faced by the world today (Grin, Rotmans, & Schot, 2010; Smith, Stirling, & Berkhout, 2005; Frantzeskaki & Loorbach, 2010). The Paris Agreement set out to combat climate change and in order to achieve this, transitions will have to occur both globally and locally, and across sectors. Questions of how to promote and govern this transition is frequently asked by social science researchers and policymakers across the world. The literature present two different views of the timing and temporal dynamics of transitions. Whereas transitions from a historical perspective is perceived as a slow and lengthy process some researchers argue future low-carbon transitions as potentially faster (Sovacool, 2016; Kern & Rogge, 2016; Bromley, 2016). Sovacool (2016) challenged the conventional and mainstream thought in the sustainability transition literature that transitions are multi-decades- or even centuries long processes. He argued that in addition to the lengthy transitions, e.g., wood to coal, faster energy transitions under certain conditions have occurred in the past as well. Kern and Rogge (2016) agrees with Sovacool that future transitions could potentially be faster “due to new knowledge of past transitions, national climate change mitigation targets and technological innovation” (p. 16). However, they argue the need to include political will and that past transitions were not planned or governed but were emergent processes. The ongoing transition

differs in that it involves a wide variety of actors trying to govern the transition in the direction of low-carbon energy systems (Kern & Rogge, 2016).

Grubler et al (2016) agrees that some transitions could potentially be fast for some locations and or sectors, and that the success stories highlighted by Sovacool (2016) provide valuable knowledge. However, they argue that grand and global sustainability transitions will take many decades to fully implement. Transitions involving stabilizing climate change and at the same time addressing pressing development goals require large scale and systemic changes and that such changes “often have little immediate adaptation benefits besides significant reduction in social and environmental externalities” (Grubler, Wilson, & Nemet, 2016). Smil (2016) also argues global energy transitions as a lengthy process that will take decades and agrees with Grubler et al (2016) that scale matters. Sovacool and Geels (2016) argues in response to the criticism mentioned above that scale do matters but disagrees with their focus on techno-economic considerations as the only driver for global or grand transitions. They warn against concluding that economy is the only driver for global transitions. Sovacool and Geels (2016) also highlight the main differences between historical transitions and future low-carbon transitions. Firstly, future low-carbon transitions differ from historical transitions in that they are driven by the global need to solve the problem of climate change and not by opportunity. Secondly, while historical transitions involved developing variations in technology, future low-carbon transitions will also involve adjusting “policies, regulation and incentives that shape markets” (p. 233). Thirdly, while past historical transitions were somewhat rooted in abundance of resources, future low-carbon transition might be rooted in scarcity of resources (Sovacool & Geels, 2016).

2.1 Path dependency

Path-dependency is a concept frequently discussed in the sustainability transition literature. Path-dependency broadly refers to the process where systems have an “inability to shake free from their history” (Martin & Sunley, 2006, p. 399). More specifically, future development outcomes of a system are dependent on a sequence of past decisions and actions up to a certain point in time (Martin & Sunley, 2006). A deeper understanding of path-dependence and lock-in as it relates to energy systems is valuable for this research project. Energy systems in the literature are often conceptualized as socio-technical systems. Such systems create lock-in due to “large sums

of labor, capital and effort” spent in the existing system (Sovacool, 2016, p. 205). Andrews-Speed argues path dependency in energy regimes is created by the paradigms, rules, interests, infrastructure and commitments supporting energy regime stability (Andrews-Speed, 2016). Regime theory, as it relates to socio-technical systems and transitions, will be discussed in greater detail in section 2.2.1.

Roger Fouquet argues that energy systems are subjected “to strong and long-lived path dependence, owing to technological, infrastructural, institutional and behavioral lock-ins” (Fouquet, 2016, p. 1). Understanding this lock-in is of vital importance when the task at hand is transitioning from a fossil fuel-based energy system to one of renewable energy. Lock-in and ultimately path-dependence is seen as a byproduct of the process of industrialization with large scales investments (Fouquet, 2016). More specifically, the concept of carbon lock-in has also been used in energy transition research. Unruh (2000) argues carbon lock-in of fossil fuel energy systems in industrial economies due to “a process of technological and institutional co-evolution driven by path-dependent increasing returns to scale” (p. 817). Furthermore, that the condition of carbon lock-in is preventing the diffusion of alternative low-carbon technologies regardless of their economic- and environmental advantages (Unruh, 2000). In the early stages of development governments often invest in large scale engineering projects and subsidy policies, a strategy to stimulate economic development and reduce poverty. This might help them achieve their development goals, but at the same time they also risk being locked into energy intensive development pathways, such as the developed economies did before them. Researchers have found a close positive relationship between per capita subsidies and per capita consumption of fossil fuels in energy producing economies. Subsidies are lobbied for by fossil fuel companies and play a significant role in the energy intensive pathways of economies. Today’s emerging and developing economies appear to be following this pathway (Fouquet, 2016).

The fossil fuel development path creates lock-in, and in order to introduce a new alternative sustainable development path the fossil fuel system must be unlocked. In developing countries this can be hindered by the need to tackle issues of poverty and social inequality. However, another layer to this is that as countries are developing, they might not have established highly organized infrastructures in e.g., the energy sector. This might ease in the transition to alternative

sustainable systems as they do not have to replace it completely to fit with the transition (Wieczorek, 2018). Path dependency theory is an important part of the theoretical framework guiding this thesis, as an energy system itself can create lock-in (Sovacool, 2016). Breaking this path dependence and un-locking fossil fuel energy systems is vital in order to transition to an alternative. In order to counteract path dependency and un-lock systems the literature agrees the need for simultaneous shifts across the systems. It requires simultaneous alterations in “technology, political and legal regulations, economics of scale and price signals, and social attitudes and values” (Sovacool, 2016, p. 205). This co-evolving of systems change is also argued in the three-perspectives framework on national energy transitions by Cherp et al (2018) presented below. The following sections presents the three-perspectives framework on national energy transitions by Cherp et al (2018) and discuss the socio-technical-, the techno-economic-, and the political perspectives comprised in the integrated framework.

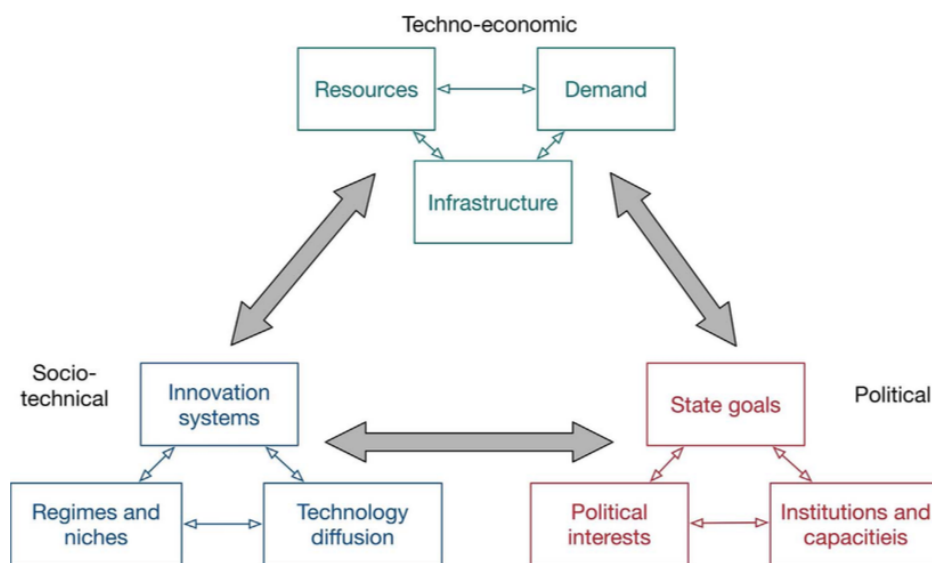
2.2 An integrated framework on national energy transitions

As the literature on transitions is interdisciplinary with an array of different analytical perspectives, Cherp et al (2018) argues it is difficult to find one theory explaining energy transitions. However, consensus of the literature exists, “since a single theory of transitions may not be feasible due to their complexity, they should instead be analyzed using several theories” (p. 175). From a historical perspective, national energy transitions have involved changes in several systems. The techno-economic system with changes in energy flows and markets. The socio-technical system with changes in technologies for extraction, transforming and utilizing energy. And the system of political actions with policy changes. Cherp et al conceptualize national energy transitions as a “co-evolution of three types of systems” (p. 175), the systems of energy-flows and markets, energy technologies and energy-related policies. This is presented in an integrated framework with three different perspectives of systems encompassing different scholarly fields (see figure 1).

The interdisciplinary integrated framework is inspired by Elinor Ostrom’s “systemic approach for researching co-evolving systems” (p. 177) and her emphasis on the use of multiple theories to describe a complex socio-ecological system. The framework uses the socio-technical perspective, techno-economic perspective and the political perspective as organizing factors. Identifying

important variables and theories that explain the interactions of the different variables of the different perspectives is an important part of the framework. The top-level variables of for example the socio-technical perspective influence each other. The perspective is also influenced by- as well as influencing both the techno-economic perspective and the political perspective (Cherp, Vinichenko, Jewell, Brutschin, & Sovacool, 2018). The focus of the socio-technical perspective is technological change, particularly the emergence and diffusion of new technology. The focus of the techno-economic perspective is energy production, consumption and trade in societies which represent the energy flows and markets. The central focus of the political perspective is policy change that affects energy systems (Cherp, Vinichenko, Jewell, Brutschin, & Sovacool, 2018). **Figure 1** present the meta-theoretical framework for analyzing national energy transitions using the three perspectives. The top-level variables of each perspective is presented and depict their interaction and connection in explaining energy transitions. The framework for analyzation is interdisciplinary and extensive, each top-level variable has several second-level variables to be analyzed. The variables needed to explain different situations will vary and not all variables will fit with every situation. The following sections will take an in dept look at each perspective and identity the variables, concepts and theories relevant for this thesis.

Figure 1: Top-level variables of the three perspectives on national energy transitions (Cherp, Vinichenko, Jewell, Brutschin, & Sovacool, 2018).



Before looking deeper into each perspective, it is important to highlight that Vietnam is in the early stages of energy transition. Therefore, the framework by Cherp et al (2018) is not used here to explain a transition that is finished. The transition process is ongoing and therefore the framework is here used as a vantage point to organize and understand the factors influencing the energy transition pathway from the Vietnamese perspective. By understanding the techno-economic, socio-technical and political factors of such a transition the aim is to highlight important factors influencing Vietnam's energy transition. Because Vietnam is a developing country, previous knowledge on sustainability transitions and socio-technical transitions in a developing context is an important layer for the theoretical framework. Previously the focus of the field was primarily placed on transitions in a more developed context, but in recent years the focus has also been increasingly placed on the developing context (Wieczorek, 2018). The next sections will take a deeper look into the three perspectives integrated in the framework and present and discuss the variables and concepts necessary for understanding energy transition in Vietnam.

2.2.1 Transition theory: Socio-technical Perspective

The systemic focus of socio-technical perspective is the energy technology embedded in socio-technical system and technological change. More specifically, the emergence and diffusion of new technologies. The top-level variables of the socio-technical perspective used in this thesis are regimes and niches, innovation systems and technology diffusion (Cherp, Vinichenko, Jewell, Brutschin, & Sovacool, 2018). The framework in figure 1 does not place emphasis on socio-technical actors specifically as an organizing top-level variable. However, behind the variable of socio-technical regimes and niches lies the actors. Socio-technical transitions are “complex and long-term process comprising multiple actors” (Geels, 2011, p. 24). Therefore, for the sake of this research the regime and niche variable will include emphasis on socio-technical actors as well.

Geels (2004) looks at the socio-technical system and defines it as the linkages between the elements necessary and responsible for fulfilling central societal functions. Technology and society are co-evolving together and interdependent. The socio-technical system is comprised of “(networks of) actors (individuals, firms and other organizations, collective actors) and institutions (societal and technical norms, regulations and standards of good practice) as well as

material artifacts and knowledge” (Markard, Raven, & Truffer, 2012, p. 956). Socio-technical systems in different countries have different characteristics. Countries face different challenges, and to account for this, country classifications such as developed and developing, or OECD and non-OECD, are frequently used in the literature. Araujo (2014) highlight such country classification as not fully accepted and especially the developed and developing classification as it “can have a highly subjective meaning with little relevance for energy” (p. 114). Israel and Herrera (2020) in researching governance and energy transition in Peru highlight the importance and role of different contexts in energy transition. Furthermore, they argue that the characteristics of the energy system (e.g., socio-technical system) itself requires classification. In doing so, they suggest the concept of expanding energy systems characterized by “overall energy generation being increased, and territorial coverage being extended” (p. 1). Comparatively, consolidated energy systems on the other hand are characterized by energy generation being constant or decreasing (Israel & Herrera, 2020). Berkhout et al (2009) phrase the development of socio-technical systems in developing Asia as emergent systems.

The socio-technical system is also referred to in the literature as socio-technical regimes to account for the path dependence and inertia experienced in various industries and sectors (Fuenfschilling & Truffer, 2014). Regimes in socio-technical systems represent “the ‘deep structure’ that account for the stability” (p. 27) of an existing system in order to fulfill a societal function. This deep structure is formed by a shared set of rules and routines embedded in the socio-technical system and its actors (Geels, 2011). Regimes are embedded in the overall landscape and the “idea behind the regime is that it imposes logic and direction for incremental socio-technical change along established pathways of development” (Markard, Raven, & Truffer, 2012, p. 957). The incumbent regime is the prevailing system and is considered relatively stable until destabilizing factors puts the regime under pressure (Lawhon & Murphy, 2011). The incumbent regime is also considered resilient in that it can adapt to external and internal pressures in order to survive or expand by promoting innovation. It is also resilient in that it can hinder innovations that are incompatible with the regime and that threaten regime stability (Cherp, Vinichenko, Jewell, Brutschin, & Sovacool, 2018). Smith et al (2005) argues, “At root, socio-technical regimes are produced and reproduced by networks of state, civil society, and market-based actors and institutions” (p. 1504). Andrews-Speed (2016) propose the energy sector to be a

particular type of socio-technical regime: the energy regime. He argues that the actions of the actors within the structure will be conditioned by the incumbent regime and the actors will “build strong political and economic interests in the prevailing regime” (Andrews-Speed, 2016, p. 217). Socio-technical systems in developing countries show less uniformity than that of regimes in western developed countries. Old technologies function alongside new technologies in fulfilling the same purpose (Wieczorek, 2018).

Transitions or system innovation occurs when there is a disruption in the system resulting in a new structure (Lawhon & Murphy, 2011). Berkhout et al (2009), highlight that economic development can be seen as the process of systems innovation with the rapid growth and embedding of emerging socio-technical systems replacing traditional modes. Classical theories of development assume economic growth to follow a predictable pattern, resulting in “convergence between the structure, growth and productivity of economics in the long-run” (p. 218) as developing countries strive to catch-up to more advanced economies. Additionally, this also results in the convergence of resource-intensity and environmental pressures associated with rapid economic growth. Berkhout et al (2009) argue that developing countries in Asia are not doomed to follow the same resource-intense and polluting development trajectory as the early industrializers. By applying the notion of system innovations from the sustainability literature it is possible to envisage a more sustainable development pathway, due to the possibility of more sustainable socio-technical regimes emerging in earlier phases of development. Such regimes will emerge in the “context of interaction between domestic and globalized markets, knowledge flows and governance” (p. 218).

Socio-technical transitions or system innovation does not occur in a vacuum. Socio-technical systems or regimes are embedded in the overall context in which transitions occur (Lawhon & Murphy, 2011). The multi-level perspective (MLP) framework on socio-technical transitions or system innovations is one of the most prominent frameworks in the literature. The MLP framework analyze the interaction between socio-technical regime, landscape and niches to understand how transitions unfold (Markard, Raven, & Truffer, 2012). The socio-technical landscape refers to the wider overall exogenous contextual developments in which socio-technical regimes are embedded and that influence the regime. The landscape cannot be directly

influenced by either the regime or niche actors (Grin, Rotmans, & Schot, 2010). Landscape developments can be slow-changing developments such as for example ideology, urbanization, industrialization, climate and socio-demographic changes (Geels, 2018; Grin, Rotmans, & Schot, 2010). It can also be in forms of exogenous shocks such as “wars, economic crises, major accidents, and political upheavals” (Geels, 2018, p. 225). Landscape changes can put pressure on the regime. Pressure on the regime can also occur from within the regime itself, e.g., internal technical problems such as bottlenecks in infrastructure (Geels, 2004). The MLP framework is useful in understanding transitions. It looks at the current energy system, e.g., the energy regime and how pressures from changes in landscape developments or the regime itself creates opportunities for niche innovations (new technology) to break through and compete with the incumbent regime. Pressures on the regime can be destabilizing to the extent that it gets replaced or the incumbent regime can adapt to these pressures by innovation (Geels, 2004; Cherp, Vinichenko, Jewell, Brutschin, & Sovacool, 2018).

The concepts of niches or niche innovation are also important in transition literature and the MLP framework. Niches are considered protected spaces where radical innovation of novel technology occurs without the interference of the prevailing regime (Markard, Raven, & Truffer, 2012). In Vietnam, where the socio-technical energy system is dependent on fossil fuels, renewable technologies such as solar and wind can be seen as niche innovations. In the context of developing economies, the MLP framework on socio-technical transitions has been critiqued on the niche level where new technology and innovation arises. Arguing that developing economies are most often than not the place where new technology originates because of the lack of capacity, resources or suitable policy frameworks (Wieczorek, 2018). Instead, the perspective should be “aimed at the societal embedding of (transferred) technology rather than its development” (p. 209). Transitions research have historically focused on developed economies but is increasingly focused on emerging and developing economies (Wieczorek, 2018). Technology diffusion is an important top-level variable in the socio-technical perspective that can be linked to what Wieczorek (2018) argues above. Technology diffusion or transfer is often seen in the lens of world systems theory with new technology arising in the core and diffuses to the periphery (Cherp, Vinichenko, Jewell, Brutschin, & Sovacool, 2018).

Raven et al (2012) notes that empirical transition research has mostly been analyzed at the national level and highlights that this is at odds with the processes of globalization and regionalization. To account for this space and scale in the MLP they suggest including the spatial dimension to be considered as a relational scale that is formed by the “network of actors across different territories” (p. 76). Arguing that the dynamics of socio-technical systems are explained not only by the structuration of the system and developments over time but also the interaction of the network of actors (Raven, Schot, & Berkhout, 2012). The relationship and interaction between actors across territorial borders are termed transnational linkages and this has been found to be an important factor in developing economies linked to global value chains. Both incumbent regime actors and niche actors are increasingly transnationally connected due to increasing global integration with flows of capital, technology and knowledge (Wieczorek, 2018).

2.2.2 Transition theory: Techno-economic Perspective

The systemic focus of the techno-economic perspective are energy flows and markets, and the top-level variables are energy resources, energy demand and energy infrastructure (Cherp, Vinichenko, Jewell, Brutschin, & Sovacool, 2018). Quantitative analysis is most often used in techno-economic analysis. This thesis does not employ quantitative analysis. However, techno-economic factors are important variables to mention as they interact with both the socio-technical system and the system of political action as seen in the meta-theoretical framework in figure 1. The secondary variables under energy resources used in this thesis are fossil fuel types, resources and reserves, import and export of fuels and potential for renewable energy. Under the demand variables we find secondary variables e.g., factors driving demand growth such as urbanization and economic growth (Cherp, Vinichenko, Jewell, Brutschin, & Sovacool, 2018). The drivers of energy demand are important factors influencing energy transition in Vietnam as the country is developing and seek to catch-up to highly developed economies. Under the variable of energy infrastructure, we find important secondary variable such as existing infrastructure for extraction, transportation, conversion and use, as well as age of this infrastructure (Cherp, Vinichenko, Jewell, Brutschin, & Sovacool, 2018).

2.2.3 Transition theory: The Political Perspective

The central focus of the political perspective is political actions and policy change that affect energy systems. The government is responsible (in most cases) for formulation and implementation of energy policy on behalf of the state, making the state and state goals the central focus for analysis. It is important to mention here that the state is also included in the techno-economic perspective, but only as an economic actor, and in the socio-technical perspective as part of the seamless web of actors or as a landscape factor. The political perspective differ here in that the state is the focus of analysis (Cherp, Vinichenko, Jewell, Brutschin, & Sovacool, 2018). The top-level variables under the political perspective in figure 1 are state goals, institutions and capacities and political interests. Under state goals we find secondary variables such as types of state goals and factors affecting state goals. Here Cherp et al (2018) highlight the state goals of energy security and climate change mitigation. Factors affecting state goals of energy security can be for example fuel import dependence. Under the top-level variable political interests is special interests. The notion of special interests is an important variable under political interest that can influence energy policy. Industrial lobbying is an example of this. As seen in section 2.2.1 incumbent energy regime actors build strong political and economic interests within the incumbent energy regime that it stands to lose if a shift occurs (Andrews-Speed, 2016). Evidence suggests that political resistance to transition to low-carbon energy by the incumbent regimes is one factor slowing down the pace of transition even in countries with strong political consensus on the need to transition (Hess, 2014).

Institutions and capacities are an important top-level variable of the political perspective. Under this variable, Cherp et al highlight three secondary variables; state capacity, institutional arrangements and international processes. Institutions are “structures and rules that enable and constrain state and other political actors” (Cherp, Vinichenko, Jewell, Brutschin, & Sovacool, 2018, p. 181). The structures and rules create predictability and shape the decisions of the actors and therefore constrain the possibility of change (Zhang & Andrews-Speed, 2020). The view of institutions as “given, static, and constraining” (p. 182) of the umbrella of neo-institutionalism have been criticized for not accounting for exogenous shocks and not being able to explain change (Cherp, Vinichenko, Jewell, Brutschin, & Sovacool, 2018). To account for the possibility of change the concept of discursive institutionalism is used and focuses on endogenous change.

Discursive institutionalism sees institutions as both “constraining structures and enabling ‘constructs of meaning’, created and maintained by agents which can change institutions using their critical discursive abilities” (Cherp, Vinichenko, Jewell, Brutschin, & Sovacool, 2018, p. 182). The concept of policy paradigms and paradigm shifts as argued by Hall (1993) is often used in illustrating this type of thinking of change (Cherp, Vinichenko, Jewell, Brutschin, & Sovacool, 2018). A policy paradigm can be defined as the “shared set of beliefs, values, ideas and principles relating to the world or a particular sector” (p. 217). The policy paradigm in policymaking can be viewed and analyzed at a global scale, national scale or at a sectoral scale e.g., the energy regime (Andrews-Speed, 2016). The policy paradigm creates a pattern or framework in which policy problems are identified and where solutions are created. Because of this framework the solutions identified and formulated within the framework of the paradigm will often be consistent with the prevailing paradigm (Andrews-Speed, 2016). According to Hall (1993) policy paradigm shift occurs when the state and other social actors agree on new ways of thinking about the problems, that creates new solutions using social learning. Sustainable development, in which the energy transition is a crucial enabling factor (United Nations , 2021), can be seen as another example of a paradigm shift for international development.

When talking about institutions the concept of state capacity becomes important. Cherp et al (2018) states that the “concept of capacity signals that a state is not able to pursue any energy related policy it desires” (p. 181) and highlights factors such economic resources and political stability. Put in another way, more broadly, the concept of state capacity has been used to examine the ability of the government to proactively take part in shaping economic development paths. The notion of developmental states including socialist market states (such as Vietnam) can be seen under the broader state capacity paradigm (Dent, 2018). Dent presents the concept of new developmentalism that combines theories of state capacity and ecological modernization to account for state capacity aimed at realizing sustainable economic growth. He argues that this is evident in East Asia “where strong forms of developmental state capacity is exercised towards meeting transformative sustainable development goals” (Dent, 2018, p. 1191). The role of international processes is also an important secondary variable here that highlights that states also interact on the international level with other states. Policy changes in one country or on the international level with international agreements can also influencing policy on national levels.

The concept of policy diffusion is often used to explain such convergence (Cherp, Vinichenko, Jewell, Brutschin, & Sovacool, 2018).

The meta-theoretical three perspectives framework on national energy transitions by Cherp et al (2018) guiding this chapter is interdisciplinary and extensive, as seen with the many concepts and theories presented above. The framework places the three perspectives as organizing principles in a meta-theoretical framework as a “nested conceptual map of variables and theories from different social sciences disciplines which we believe are necessary for explaining specific cases and broader classes of national energy transitions“ Cherp et al (2018, p. 187). The framework creating this map of variables and theories is in this thesis used to map important factors under each perspective as highlighted from the Vietnamese perspective that influence the ongoing energy transition pathway.

3. Methodology

The choice of topic for this research project came about during a six-month internship at the Royal Norwegian Embassy in Hanoi in the fall 2019. The internship provided me with valuable background information on Vietnam's development path and challenges of sustainable development. This research project uses a qualitative approach. According to Hay (2016), qualitative research encompasses the whole research process from start to finish as it aims to explain human environments, social processes and individual experiences. Hay (2016) highlights that qualitative methodology allows for multiple meanings and interpretations as the researcher is not "seeking to impose any one the 'dominant' or 'correct' interpretation" (p. 8). This makes qualitative methodology an appropriate method due to the interdisciplinary and multifaced nature of energy transitions as highlighted by the meta-theoretical three perspectives framework by Cherp et (2018).

This research project uses the textual method of document analysis. Written text has been used as "a source of underlying discourses that underpin and legitimate social structures" (Hay, 2016, p. 12). Asdal and Reinertsen (2020) highlight that written text or documents can be seen as having two features. Firstly, written text can be seen as a result of an act of documentation, and secondly, written text always stands in relation to something else (p. 15). Furthermore, documents are an integral part of its context e.g., the occasion or situation in which the document was written. Documents have the potential to intervene in and change their context (Asdal & Reinertsen, 2020, pp. 15-16). Documents can also entail information that raises questions as well as provide the means to track changes and developments (Bowen, 2009, p. 30). Like other analytical methods in qualitative research document analysis requires the data gathered to be evaluated and analyzed "in order to elicit meaning, gain understanding and develop empirical knowledge" (Bowen, 2009, p. 27).

Using qualitative methodology also places the researcher within the research differently than quantitative research through engaging in critical reflexivity. Kim England (1994), defined reflexivity as "a process of constant, self-conscious scrutiny of the self as researcher and of the research process" (Hay, 2016, p. 34). Being reflexive in one's research and the research process involves analyzing oneself as a researcher and the situation in terms of ethical codes of conduct

and ethical dilemmas arising during the process. Hay (2016) states, “as geographers engaged in research, we must always consider the ethical implications of our activities” (Hay, 2016, p. 34). Positionality is another important aspect of ethics in qualitative research. Hay (2016) defines positionality as “a researcher’s social, locational, and ideological placement relative to the research project or to other participants in it” (p. 451). Factors that may influence a researcher’s positionality is class, race, gender and past formative experiences (Hay, 2016). The internship, as mentioned previously, provided valuable insights and background knowledge of Vietnam’s development path and current challenges. As my stay in Vietnam informed the chosen topic of this thesis it is important to define my positionality. My stay in Vietnam came about as a student in the Master Program Globalization and Sustainable Development at Norwegian University of Science and Technology (NTNU). I also worked closely with Innovation Norway during my internship. Innovation Norway aim to “assist Norwegian businesses grow and find new markets” (Innovation Norway, 2021). In my work here I assisted with events and meetings aimed at creating networks between Norwegian and Vietnamese businesses, particularly in the energy sector. As a student from Norway, a social-democratic country, and as a person interested and invested in sustainability and the global fight against climate change, I find the topic of energy transition very important as it relates to the future of our planet. For me as a researcher, being aware of my positionality is very important throughout the duration of the research process, from start to finish in order to ensure rigor.

Due to the circumstances surrounding the Covid-19 Pandemic and the scope and timeframe this research project relies exclusively on secondary data and secondary literature. Valuable secondary data on background information and context was acquired during the internship in forms of governmental reports and reports by international organizations. The **Vietnam Energy Outlook Report 2019** and the newest version **Vietnam Energy Outlook Report 2021** by the Electricity and Renewable Energy Authority under the Ministry of Industry and Trade (MOIT) together with the Danish Energy Agency provided valuable information on the current status of the energy sector as well as future energy outlooks and scenarios. **The Vietnam 2035: Towards Prosperity, Creativity, Equity and Democracy** by the World Bank and Ministry of Planning and Investment (MPI) of Vietnam provided useful background information on Vietnam history and development path. These reports in addition to valuable data from the International Energy

Agency, the World Bank, United Nations Development Programme as well as relevant news articles provided useful background information on the situation in Vietnam and the global and national context of the ongoing energy transition. However, more secondary data was needed in order to attempt to answer the research questions guiding this thesis. More data was needed in form of policy documents as this thesis aims to understand what an energy transition looks like from the Vietnamese perspective.

Initially I aimed to use the official websites and portals of the Vietnamese government and relevant ministries (MOIT, MPI and MONRE) to gather relevant data on energy policy and strategy. However, during this process the challenge of language translation occurred as not all available official websites or policy documents had English translations. Additionally, only a limited number of policy documents were available on the government portal or websites. The policy documents needed for this thesis was therefore mostly attained using the German Agency for International Cooperation Energy Support Programme (GIZ ESP) website. The GIZ ESP is supporting Vietnam in developing renewable energy and energy efficiency markets (GIZ Energy Support Programme, 2023). The Climate Change Laws of the World database by the Grantham Research Institute at London School of Economics and the Sabin Center at Columbia Law School was also used to find relevant data when the data was unavailable at the GIZ ESP website. Data collection of secondary literature for the theoretical framework was conducted using the NTNU online university library portal (Oria) as well as Google Scholar. The keywords used to focus the literature review of existing research on sustainability transitions was: **Energy Transition, Sustainability Transitions** and **Socio-Technical Transitions**. A literature review was also conducted on the current state of knowledge on the Vietnamese energy sector as it relates to the topic of energy transition. The keywords used here was: **Vietnam, Energy, Policy, Renewable Energy** and **Climate Change**. When using secondary literature, the researcher should be mindful in interpreting and presenting the research correctly and with respect of the opinions of other researchers, whether agreeing or not.

This study investigates Vietnam's perspective on energy transition by analyzing official energy and climate change policy, - plans, - and strategy- documents. In the research area of politics and bureaucracy, Asdal and Reinertsen (2020) highlight the analytical method of viewing documents

as tools. Specifically, that documents are instruments to make something into reality, to persuade and set an agenda in motion. Documents initiate something and are used by someone for a specific reason. When looking at documents as tools it also implies that documents are not neutral, and that documents are shaping the case in which they are involved in. Official documents are an important part of the processes and systems of governance (Asdal & Reinertsen, 2020). Official energy policy documents are important when looking at energy transition. Additionally, and more obvious is analyzing documents as text with documents having a sender and intended readers, structure, builds an argument and creates a narrative. It is also important to look at what the text says, what is less prominent and or what is not included in the text (Asdal & Reinertsen, 2020). Qualitative research encompasses the whole research process from start to finish and research design is important in establishing trust and ensuring rigor throughout the research process (Hay, 2016). As official documents can present a particular narrative the data was triangulated by contrasting the information with other sources of information and other publications. This is also important with regards to news articles. The news media in Vietnam is state-owned and closely controlled by the CPV. Vietnam is ranked at the bottom of the Press Freedom Index in 2022 with the score of 174 out of the 180 countries and territories included. Vietnam is currently the third largest jailer of journalists (Reporters Without Borders, 2023).

The process of deciding which documents to use started off as investigative by understanding which documents are important in the topic of energy transition in Vietnam. Since energy transition is closely linked to the Paris Agreement Vietnam's submissions here became the vantage point. Vietnam's NDCs under the Paris Agreement entail both climate change adaptation- and mitigation measures. Since transitioning from fossil fuel to renewable energy is reducing emissions and then mitigating climate change the focus is here placed on Vietnam's mitigation measures. Vietnam's climate change and green growth strategies are also included here as they are both specifically mentioned in their first submission under the Paris Agreement. The next step was then to identify important documents directly involved in the direction of energy development. Due to the scope and timeframe, and to constrain the research area in a topic which is quite wide the focus was here placed on Vietnam's overarching strategy on energy development and transition. The Renewable Energy Development Strategy from 2015 and the

Politburo’s Orientations on future National Energy Development Strategy and its Action Programme from 2020 was chosen to see how the country looks at low carbon energy development. Additionally, Vietnam’s Power Development Plans was chosen since coal holds the largest share of the country’s power generation. The Vietnam Energy Outlook reports, as mentioned above, is also used in this analysis as it is stated on the MOIT government portal news section that the 2021 report is expected to “give concrete inputs to the implementation of Vietnam’s National Power Development Plan No 8 (PDP8), the National Energy Master Plans, the Vietnamese Climate Change Strategy and other governmental plans and strategies” (Ministry of Industry and Trade of the Socialist Republic of Vietnam, 2022). Vietnam and its international development partners established the Viet Nam Energy Partnership Group (VEPG) in 2017. The Energy Outlook Reports is a product of the Danish Energy Partnership Programme with Vietnam under the VEPG. The group’s objective is to “work towards effective and efficient international support to the government of Viet Nam and engage stakeholders to deliver a sustainable energy transition in Viet Nam, in line with national law and international agreements of which Viet Nam is a member” (Viet Nam Energy Partnership Group, 2023). The range of documents used in this thesis, as seen in table 1, are placed into four categories: intergovernmental reports, policy documents, Paris Agreement submissions and Power Development Plans. The category policy documents is used for Vietnam’s strategies on green growth, climate change and energy development.

Table 1: Overview of documents used in analysis.

Type of Document	Year	Title
Intergovernmental Report	2019	Vietnam Energy Outlook Report 2019
Intergovernmental Report	2022	Vietnam Energy Outlook Report 2021
Policy document	2011	National Strategy on Climate Change
Policy document *	2022	Decision: No. 896/QĐ-TTg on approving national strategy for climate change until 2050. – Summary of main targets by Climate Change Laws of the world
Policy document	2012	Vietnam Green Growth Strategy
Policy document	2021	Decision: To Ratify the National Green Growth Strategy for the 2021-2030 period, vision towards 2050

Policy document	2015	Decision: Approving the Viet Nam's Renewable Energy Development Strategy up to 2030 with an outlook to 2050
Policy document	2007	Approving Vietnam's National Energy Development Strategy up to 2020, with vision to 2050
Policy document	2020	RESOLUTION OF THE POLITBURO On Orientations of the Viet Nam's National Energy Development Strategy to 2030 and outlook to 2045
Policy document	2020	Promulgating the Government's Action Programme for implementing Resolution no. 55-NQ/TW dated 11/02/2020 of Politburo regarding orientations of the Vietnamese National Energy Development Strategy until 2030, with a vision till 2045
Paris Agreement submission	2016	Plan for Implementation of Paris Agreement
Paris Agreement submission	2016	Intended Nationally Determined Contribution of Viet Nam
Paris Agreement submission	2020	National Determined Contributions (NDC) updated in 2020
Paris Agreement submission	2022	National Determined Contributions (NDC) Updated in 2022
Power Development Plan 7	2011	Decision No. 1208/QD-TTg dated July 21, 2011 of the Prime Minister approving the national master plan for power development in the 2011 – 2020 period, with consideration to 2030
Power Development Plan 7 Revised	2016	DECISION: on the Approval of the Revised National Power Development Master Plan for the 2011-2020 Period with the Vision to 2030
Power Development Plan 8 - Draft	2021	DRAFT VERSION: Decision: Approving the National Power Development Plan in the 2021 – 2030 period, with vision to 2045

*Note: Not able to attain English version of document so the summary of main targets by Climate Change Laws of the World database is used.

3.1 Limitations

The topic of this thesis is wide and offers many opportunities for analysis. This thesis gives an overview perspective on energy transition in Vietnam using the three-perspectives framework by Cherp et al (2018) to highlight important factors influencing energy transition. Since the theoretical framework used is extensive, and as a result of the scope and timeframe, some of the factors are only slightly touched upon and could benefit from greater in-depth analysis. Such as political interests and infrastructure. Additionally, only secondary data is used. Interviews with relevant actors in energy transition would strengthen the empirical validity of this research. Specifically, interviews with relevant government actors, development partners and renewable energy companies in Vietnam.

4. Analysis of Vietnam's perspective on the ongoing energy transition

Chapter 4, 5, and 6, will present and analyze the findings of this thesis. The aim is to get an overview of what an energy transition looks like from the Vietnamese perspective. In doing so the three-perspective framework by Cherp et al (2018) is used to highlight important techno-economic, - socio-technical, - and political factors influencing Vietnam's energy transition pathway. Chapter 4 analyze important political factors and the role of the state using the political perspective. The central focus of the political perspective is policy change that affect energy systems. Chapter 5 looks at the techno-economic factors influencing Vietnam's energy transition pathway and analyze how these factors influence the socio-technical energy regime and energy policy. Chapter 6 highlight important socio-technical factors and present an overview of the actors in energy transition in Vietnam as highlighted by the documents. The analysis concludes with chapter 7 summarizing the findings. The findings are in chapter 7 mapped using the three-perspectives framework and organized using the top-level variables of each perspective.

4.1 Political perspective on energy transition in Vietnam

This chapter attempts to understand the political factors influencing energy transition in Vietnam. It takes a closer look at Vietnam's perspective on energy policy and capacities as it relates to the ongoing energy transition. This section uses mostly Vietnam's Paris Agreement submissions, policy documents and Power Development Plans as seen in table 1. The category policy documents include Vietnam's strategies on green growth, climate change and energy development. The chapter is organized using the top-level variables of state goals, institutions and capacities and political interests.

4.1.1 State goals

Vietnam has put forth several state goals influencing the direction of energy policy in Vietnam. Vietnam is balancing state goals of both ensuring national energy security (balancing energy supply and demand) as well as low-carbon development with their net-zero emissions target by 2050 (as set out in their NDC's, National Climate Change Strategy, Vietnam Green Growth Strategy and Politburo's Orientations on Future Energy Development). Simultaneously, Vietnam is aiming for continued strong economic growth. In the draft version (September 2021) of the

country's Power Development Plan (PDP8) for the coming period the government highlight the annual average GDP growth target of about 6 percent until 2024 (Socialist Republic of Viet Nam, 2021). GHG emissions in a developing economy highly reliant on fossil fuels is poised to increase significantly unless Vietnam accelerate its transition to renewable energy. Balancing national energy security with effective climate change mitigation is a challenge for a developing and emerging economy and Vietnam highlight the need for international support in their NDC submissions under the Paris Agreement (Socialist Republic of Viet Nam, 2016; Socialist Republic of Viet Nam, 2020; Socialist Republic of Viet Nam, 2022). The following section analyzes Vietnam's perspective on the different state goals.

4.1.1.1 Low-carbon development and net-zero emissions by 2050.

The global integration trends of sustainability, low-carbon development and green growth has influenced climate change and energy policy in Vietnam. Vietnam approved its National Strategy on Climate Change in 2011. The strategy recognized the unsustainable model of business-as-usual development used by developed countries and highlights the need for low-carbon- and sustainable development. The strategy also recognizes the importance of harmonization of policies at the national level and international level. As mitigation policies are increasingly gaining importance globally it is in developing countries interest to align their national policies with the global trends to overcome the possible new trade barriers of such a shift (Socialist Republic of Viet Nam, 2011). In 2012 the government of Vietnam approved their National Green Growth Strategy for the period 2011 – 2020, with a vision to 2050. The strategy promotes low-carbon economic development and in 2021 the government updated the strategy for the coming period and state that they aim for carbon neutrality in the long run (Socialist Republic of Viet Nam, 2021; Socialist Republic of Viet Nam, 2012). The strategy does not present a net-zero emissions target year but at COP26 Vietnam presented in their NDC 2022 the target of net-zero emission by 2050 (Socialist Republic of Viet Nam, 2022). The net-zero emissions target is highlighted in the newest National Strategy for Climate Change from 2022 (Climate Change Laws of the World, 2023). The progression of state goals with the climate change- and green growth strategies from the 2011 until 2022 paints a picture of policy change aligned with the international climate change agenda. This can be seen as policy diffusion according to the theoretical framework. Vietnam is participating in the international climate change agenda with the Paris Agreement and

their NDC submissions. **Table 2** below presents Vietnam’s emissions reduction targets of their NDCs compared to the business-as-usual scenario (BAU) using national GHG inventory (Socialist Republic of Viet Nam, 2016; Socialist Republic of Viet Nam, 2020; Socialist Republic of Viet Nam, 2022). The BAU was developed with assumptions on economic growth and the absence of climate change policies (Socialist Republic of Viet Nam, 2022).

Table 2: GHG emissions reduction targets by 2030 compared to BAU scenario in NDC submissions.

NDC Submissions	Unconditional Target	Conditional Target
INDC 2016*	8 %	25 %
NDC 2020	9 %	27 %
NDC 2022	15.8 %	43.5 %

Note: * INDC from 2016 used GHG inventory from 2010 while NDC 2020 and 2022 uses updated GHG inventory from 2014.

As seen in table 2, Vietnam has increased their GHG mitigation targets significantly from their initial target in 2016. The targets slightly increased from 2016 to 2020 but increased significantly in their newest NDC from 2022 with an unconditional target of 15.8 percent and a conditional target of 43.5 percent by 2030. Vietnam’s submission under the Paris Agreement and the role of international agreements will be analyzed further in section 4.1.2, as it relates to Vietnam’s institutions and capacities in the ongoing energy transition.

4.1.1.2 National energy security and strong economic growth

Ensuring national energy security is of vital importance for the socio-economic development goals of Vietnam. As seen in chapter 1, Vietnam is experiencing strong economic growth and strive to continue to do so, as indicated by their near 6% GDP growth target the coming decades (Socialist Republic of Viet Nam, 2021). Resolution no. 55-NQ/TW (February 2020) of the Politburo of the Central Committee of the CPV on “the orientation of the Viet Nam’s National Energy Development Strategy to 2030 and outlook to 2045” sets direction for future energy development. It serves as the foundation for the new and upcoming National Energy

Development Strategy (NEDS), National Energy Master Plan, Power Development Plan and other development strategies of energy sub-sectors to be developed and implemented by the responsible government line ministries (Socialist Republic of Viet Nam, 2020B, pp. 1,15). It lays out Vietnam's energy development priorities for the next decades. Resolution 55 presents five strategic orientations in paragraph form, this thesis summarizes the five orientations as objectives encompassing: energy security, energy market liberalization reform, energy diversification, modern technology and digitalization of the sector, and energy efficiency and environmental protection. From Vietnam's perspective in Resolution 55 the energy sector has been successful in meeting the overall targets and orientations the past 15 years. However, challenges still exist in ensuring national energy security (Socialist Republic of Viet Nam, 2020B). Challenges in ensuring national energy security is highlighted in their NDC 2020 as a challenge in climate change mitigation (Socialist Republic of Viet Nam, 2020). Vietnam's challenges of energy security will be analyzed in greater detail in the chapters concerning the techno-economic- and the socio-technical perspective.

4.1.2 Institutions and capacities

This section analyzes Vietnam's perspective on institutions and capacities in the ongoing energy transition. Important secondary variables here are state capacity, such as economic and other resources, and the role of international processes e.g., international agreements and policy diffusion. The climate change and green growth strategies as well as Vietnam's NDC's highlighted above represents important institutions for Vietnam's future development path, as they set state goals that influence energy development in Vietnam. The section starts by analyzing the main overarching structures e.g., institutions for mitigation and looks closer at Vietnam's submissions under the Paris Agreement. Then it takes a closer look at important policies and strategies on energy development with a particular focus on renewable energy. Vietnam's National Renewable Energy Development Strategy (REDS) from 2015 and Resolution 55 is highlighted here. The Power Development Plans (PDP) are also used here to show the evolution of policy change since the PDP 7 and its revision in 2016 and the newest draft version of PDP 8 from September 2021.

4.1.2.1 International processes: Vietnam's Paris Agreement Commitment

Vietnam's submissions under the Paris Agreement are here used to highlight the role of international processes e.g., the global climate change agenda. Vietnam sets out to transition from fossil fuels to renewables energy with the net-zero emissions target as presented in their newest NDC (Socialist Republic of Viet Nam, 2022). The Paris Agreement and Vietnam's NDCs plays an important part of the overarching institutional structure of climate change mitigation and subsequently the country's energy transition pathway. When Vietnam committed to the responsibilities of the Paris Agreement in 2016 they issued the Plan for Implementation of Paris Agreement (PIPA) outlining the country's plan for meeting the NDC targets (Socialist Republic of Viet Nam, 2016; Socialist Republic of Viet Nam, 2016B). The general timeframe of the PIPA is 2030 and the timeframe is divided into two phases. In the first phase, the period from 2016 to 2020, attention was given to the "preparation of readiness" (p. 4) to carry out the responsibilities of the Paris Agreement. In the second phase, the period from 2021 to 2030, attention is given to achieving Vietnam's NDC (Socialist Republic of Viet Nam, 2016B).

The PIPA describes aspects of what can be seen as the institutional landscape, the context, of the policy sphere of the climate change response and energy transition in Vietnam as it correlates with achieving the emissions reductions targets. The plan, in their overall objective and specific objectives, describe barriers needed to overcome to be able to achieve NDC targets. Vietnam need to prepare in terms of human, - technological, - and financial resources in order to fulfill the commitments and to transition to what the government in Vietnam terms "a low-carbon, highly resilient economy" (Socialist Republic of Viet Nam, 2016B, p. 3). The PIPA also highlight the need to revise institutions and polices in order to be able to meet the mitigation target of the NDC. This include developing and revising legal documents as well as defining "responsibilities of ministries, sectors and localities" (p. 2). Additionally, they state to make adjustment to "polices, strategies, national plans to harmonize between climate change response and socio-economic development; enhance coordination in handling regional and inter-sectoral issues; attract private resources and international support" (Socialist Republic of Viet Nam, 2016B, p. 3). The plan identified that the institutional structure at the time in 2016 did not match with the goals and implementation of the Paris Agreement and that it needed to be adjusted. This can be seen in relation to policy diffusion as highlighted in the theoretical framework under the political

perspective and the role of international processes in somewhat shaping national policies. Furthermore, Vietnam's net-zero emissions target can also be seen as this type of policy diffusion resulting from external landscape pressures of the international community with the global climate change agenda affecting the direction of policy change in Vietnam. Vietnam also signed The Global Coal to Clean Power Transition Statement to phase out unabated coal power during COP26 and highlights this in their NDC 2022 (UNFCCC, 2021; Socialist Republic of Viet Nam, 2022). The next section analyzes Vietnam's perspective on energy development and particularly renewable energy.

4.1.2.1.1 Vietnam's perspective on renewable energy development

For Vietnam to transition away from fossil fuels and focus on renewable energy, this must be put into focus in the country's energy development strategies and plans. The 2015 National Renewable Energy Development Strategy (REDS) up to 2030 with an outlook to 2050 represents somewhat of a policy shift in energy development, as it placed greater emphasis on renewable energy development than the NEDS from 2007. The REDS strategy aims to mobilize resources to accelerate renewable energy development to reduce dependence on fossil fuels to further energy security and mitigate climate change. Prior to this, renewable energy and energy intensity targets had been mentioned in other policies, such as the NEDS 2007, the National Strategy on Climate Change from 2011, and the Green Growth Strategy from 2012. However, these targets were mentioned in a general manner of about 5% of total commercial primary energy by 2020 and 11% by 2050 and did not specify sub-sector targets for non-hydro renewables such as solar and wind (Socialist Republic of Viet Nam, 2012; Socialist Republic of Viet Nam, 2011; Socialist Republic of Viet Nam, 2007). The PDP 7 from 2011 set out some renewable energy targets and this will be analyzed in section 4.1.2.1.2. Of the overarching energy strategy documents used in this thesis the REDS strategy is the first to formulate specific sub-sector targets for non-hydro renewables. The strategy aims to contribute to GHG emissions reductions and presents emissions reductions targets compared to a BAU scenario for the energy sector of 5% by 2020 and 25% in 2030 and further reductions of 45% by 2045 (Socialist Republic of Viet Nam, 2015, p. 2).

The REDS set the following targets. The renewable share in total primary energy consumption shall be 31% in 2020 and increase to 32.3% in 2030 and 43% in 2050. The renewable share in

electricity production shall increase from approx. 35% in 2015 to 38% in 2020, 32% in 2030 and further to 43% in 2050 (Socialist Republic of Viet Nam, 2015, p. 3). Specific targets by subsectors are also presented in the strategy. As hydropower is well established in the country already, the targets for non-hydro renewables wind and solar are important for an energy transition from fossil fuels. The strategy states: “Onshore wind power shall be prioritized for the period up to 2030; the R&D activities shall be conducted for offshore wind power from 2030 onwards” (p. 5). Targets for the share of wind power in total electricity production is set at 1% in 2020 and increasing to 2.7% in 2030 and about 5% in 2050. Targets for the share of solar power in total electricity production is set at 0.5% in 2020 and increasing to 6% in 2030 and 20% by 2050 (Socialist Republic of Viet Nam, 2015, pp. 5,6). The REDS strategy was also the first energy policy document to mentioned economic instruments to incentivize investment in renewables. The REDS highlights supporting schemes and policies for renewable energy development, such as Feed-In-Tariffs to accelerate investment and Renewable Portfolio Standards for power generation and distribution entities requiring installed capacity of renewables to not be less than 3% by 2020, 10% by 2020 and 20% by 2050. As well as tax incentives, preferential treatment for land etc. to incentives consumers and energy developers to use and develop renewable energy (Socialist Republic of Viet Nam, 2015).

As seen above, the REDS put forth the goal to accelerate renewable energy development and Vietnam has had recent success with solar and wind, as seen in chapter 1. Due to this recent success with non-hydro renewables the question then asked during this research project was whether Vietnam will continue this success and increase their renewable energy development targets as they strive to be net-zero by 2050. Resolution 55 is an important document in this regard, as it gives direction on future energy development in Vietnam. It is worth noting that Resolution 55 is from 2020 and that the net-zero target was announced in 2021. In resolution 55 they state to “Formulate breakthrough mechanisms and polices to encourage and promote remarkable development of renewable energy sources towards maximal replacement of fossil energy sources” (p. 6). This is signaling political will from the Politburo to increase the share of renewable energy. Resolution 55 does not use the wording *transition* but as seen above states “maximal replacement of fossil energy sources” (p. 6). Further they state to “Prioritize the use of wind and solar power for electricity generation” (p. 6), and gas-fired power development to

replace the share of coal-fired power. However, in addition to focusing ramping up renewable energy and diversifying energy, the country is still heavily reliant on fossil fuels for ensuring national energy security (Socialist Republic of Viet Nam, 2020B). Vietnam’s energy resources, current energy system and fossil fuel dependence will be analyzed under the techno-economic- and socio-technical perspective in the coming chapters. Regarding the state of renewable energy Resolution 55 highlights that while development of hydro saw rapid growth earlier, wind and solar have in recent years increased at a high rate. The resolution puts forth the targets of renewable energy of total primary energy supply to reach 15 – 20 % by 2030 and 25 – 30 % by 2045 (Socialist Republic of Viet Nam, 2020B, p. 4).

4.1.2.1.2 Policy shifts in Power Development

This section analyzes Vietnam’s energy policy planning in the power sector using the Power Development Plans (PDP). PDP 7 from 2011, PDP 7 Revised from 2016 and the draft version of PDP 8 are used in this section (Socialist Republic of Viet Nam, 2011; Socialist Republic of Viet Nam, 2016A; Socialist Republic of Viet Nam, 2021). The PDPs are developed by MOIT and the new PDP 8 is expected to follow the orientations of Resolution 55 by the Politburo (Socialist Republic of Viet Nam, 2020B). According to the Government Action Programme of Resolution 55 the PDP 8 was to be finalized in 2020-2021 (Socialist Republic of Viet Nam, 2020A), but is currently still in the works.

Table 3: Evolution of Power Development Plan targets. Structure of power sources of total capacity of power plants. Including total capacity targets (MW).

Year	Master Plan	Source	2020	2025	2030	2045
2011	PDP 7	Hydro	25.5%	-	15.7%	
		RE*	5.6%	-	9.4%	
		Coal	48%	-	51.6%	
		Gas	16.5%	-	11.8%	
		Nuclear	1.3%	-	6.6%	
		Import	3.1%	-	4.9%	
Total capacity power plants			75,000	-	146,800	

2016	PDP 7 (Revised)	Hydro	30.1%	21.5%	16.9%	
		RE**	9.9%	12.5%	21%	
		Coal	42.7%	49.3%	42.6%	
		Gas	14.9%	15.6%	14.7%	
		Nuclear	-	-	3.6%	
		Import	2.4%	1.5%	1.2	
Total capacity power plants			60,000	96,500	129,500	
2021	PDP 8 (Draft version)	Hydro****	24.06-24.73%		17.73-19.5%	9.1-11.1%
		RE***	28.96-29.95%		24.3-25.7%	40.1-40.7%
		Coal	27.96-28.67%		28.3-31.2%	15.4-19.4%
		Gas (including LNG)	13.54-13.89%		21.1—22.3%	20.6-21.2%
		Import	3.75-4.49%		3-4%	3.4%
Total capacity power plants			102,656-105,265	130,371-143,839	261,951-329,610	

Notes: *RE in plan refers to total non-hydro renewables (wind and biomass) **RE in revised plan refers to wind, solar, biomass and small hydropower. ***RE in draft version refers to solar, wind and biomass.

****Hydro in draft version includes both large, - medium, - and small- scale hydropower.

Starting with PDP 7, as evident from the structure of power sources, Vietnam relied heavily on coal-fired power plants, then hydro and gas, and had very modest non-hydro renewable power targets in their power planning. PDP 7 from 2011 with orientations to 2030 increased the percentage share of coal from 48% in 2020 to 51.6% in 2030. The non-hydro RE target also increased from 5.6% in 2020 to 9.4% in 2030. However, as evident from PDP7 the power sector planning relied heavily on fossil fuel, particularly coal-fired power plants. Table 3 also includes total capacity of power plants by year in MW for each plan. In PDP 7 we see that the total capacity was planned to nearly double from 75,000MW in 2020 up to 146,800MW by 2030. This paints a picture of the use of coal nearly doubling as well with new coal plants investments needed to fill the increased generation capacity target as evident from the plan (Socialist Republic of Viet Nam, 2011). In 2016 the PDP 7 was revised, and this was earlier than expected. The PDP 7 revision placed a bigger emphasis on renewable power sources and reduced the amount of coal fired power compared to previous version. The revision's objective, with increased focus on renewable power sources was to enhance energy security through diversification with the purpose

of reducing the coal import dependence as well as climate change mitigation (Socialist Republic of Viet Nam, 2016A). As seen table 3 the revised PDP 7 more than doubled the RE target (wind, solar, biomass and small hydro) in 2030 from 9.4% (PDP7) to 21%. The revised plan also presented a new target year of 2025, and set the RE target of 12.5%. Additionally, the plan reduced the coal target in 2020 from 48% (PDP7) to 42.7%. The revision then increases the use of coal to 49.3% in 2025 before reducing the percentage structure of coal in 2030 to 42.6% instead of the 51.6% target of PDP7. The revision also decreases the targets of total capacity of power plants compared to PDP7 which signals fewer coal-fired power plants being development than previous planning.

Since the newest plan, PDP 8, for the period 2021 – 2030 with a vision to 2045 is not yet finished, this thesis uses the draft version of the PDP 8 from September 2021 (Socialist Republic of Viet Nam, 2021). As seen in table 3 the draft version of PDP 8 continues to reduce the percentage share of coal in the structure of power sources compared to the revision plan. The draft PDP 8 sets coal at approx. 28% in 2025 while PDP 7 revised set coal at 49.3% in 2025. Coal increases in PDP 8 in 2030 to approx. 30% but this is a decrease from the previous revised plan that put coal at 42.6% in 2030. In 2045 the PDP 8 have turned coal and RE (solar, wind and biomass) upside down aiming for RE in 2045 to be approx. 40% and coal at 15-19%. Even though the use of coal is decreasing in percentage share of the power mix, the installed generation capacity is increasing in PDP 8. Total capacity of power plants in 2030 is set at approx. 130,371-143,839 and nearly doubles by 2045 at approx. 261,951-329,610. This paints a picture of an expanding energy system as seen in the theoretical framework. Emissions in an expanding energy system reliant on fossil fuel, particularly coal, is expected to increase. In PDP 8 Vietnam present an appendix of “key national and investment-prioritized power projects by development scenarios” (p. 15). In the period from 2021 – 2035 they list 27 projects with a total of approx. 30 GW of added capacity of coal-fired power plants. There are no new coal projects mentioned in the period 2036 – 2045 (Socialist Republic of Viet Nam, 2021).

Table 4 below presents specific sub-sector targets of solar and wind as presented in the power development plans (Socialist Republic of Viet Nam, 2011; Socialist Republic of Viet Nam, 2016A; Socialist Republic of Viet Nam, 2021). PDP 7 from 2011 presented no solar power

targets. The plan saw wind power reaching 1000 MW in 2020 and increasing to 6,200 MW by 2030. The revised PDP 7 from 2016 decreased the wind target but placed a greater emphasis on solar power with a target of 4,000 MW in 2025 and further 12,000 MW in 2030. The draft version of PDP 8 significantly increased targets of solar and wind compared to previous plans (Socialist Republic of Viet Nam, 2021).

Table 4: Evolution of solar and wind targets (MW) in Power Development Plans.

	2020	2025	2030	2045
PDP 7				
Solar	-	-	-	-
Wind	1,000	-	6,200	-
PDP 7 Revised				
Solar	850	4,000	12,000	-
Wind	800	2,000	6,000	-
PDP 8 Draft				
Solar	-	17,240 -18,540	18,640 -22,040	51,540-63,540
Wind	-	11,320 -11,820	13,820 -15,820	48,110-68,720

Looking specifically at the history of the power development plans, informed by the national energy development strategies, it signals the ongoing energy transition when looking at the power sector. However, as seen in chapter 1, Vietnam reached by the end of 2020 a total installed solar PV capacity of 16.500 MW which surpasses the PDP 7 revised target in 2020, 2025 and even 2030 as seen in table 4. As Vietnam has already reached the targets, it seems somewhat of a slowdown in the draft PDP8 regarding solar power targets. Then the questions asked here is why this is? The next section looks at state capacity and analyzes Vietnam’s perspective on their capacity for energy transition.

4.1.2.2 State capacity for energy transition

State capacity as presented in the theoretical framework highlight that energy policy changes is dependent on the state's capacity. Vietnam's state capacity with regards to Paris Agreement implementation can be seen as linked to Vietnam's capacity for energy transition, as energy transition correlates with Vietnam's mitigation measures. In the PIPA Vietnam describes a country hard hit by climate change and that implementation of Paris Agreement commitments needs to be suitable with the country's development level and the level of international support received (Socialist Republic of Viet Nam, 2016B). In the NDC from 2020 Vietnam specify international support as received though bilateral- and multilateral cooperation as well as the market and non-market mechanisms under Article 6 of the Paris Agreement (Socialist Republic of Viet Nam, 2020). The financing of NDC implementation is an important aspect of Vietnam's Paris Agreement submissions. In the NDC from 2022 Vietnam state that it will cost 21.7 billion USD to achieve the unconditional target of reducing emissions by 15.8% by 2030 compared to the BAU (p. 34). Vietnam highlights that Vietnam are not able to meet the financial needs alone (Socialist Republic of Viet Nam, 2022). This is also highlighted in the NDC from 2020 where they state that as a middle-income country hard hit by frequent natural disasters in addition to the negative effects of the covid-19 pandemic the scale of capital needed "is huge for Vietnam" (Socialist Republic of Viet Nam, 2020, p. 23). This is signaling that Vietnam has limited financial capacity and that Vietnam needs international support in the ongoing energy transition.

The need for international support for mitigation in form of capital and investments, technology and capacity building are highlighted in all of Vietnam's Paris Agreement submissions (PIPA, INDC, NDC 2020 and NDC 2022). Vietnam emphasizes in NDC 2020 and NDC 2022 the global goal of the Paris Agreement to adjust global financial flows in line with the low-carbon development and highlight that as a country implementing its international commitments they have the opportunity to attract international support (Socialist Republic of Viet Nam, 2020; Socialist Republic of Viet Nam, 2022). They link that as the mitigation measures in the NDC are in line with state policies, development plans and REDS strategy etc. Vietnam has the potential to attract domestic and international investment (Socialist Republic of Viet Nam, 2020). In the NDC 2020 Vietnam highlights mobilization of financial resources such as Official Development Assistance (ODA), domestic and international specialized funds, investment capital from

domestic business sector and FDI in addition to investment by individuals and households (Socialist Republic of Viet Nam, 2020). Furthermore, they state “The State formulates a legal basis to encourage financial institutions, and domestic and foreign enterprises to invest in fulfilling Viet Nam’s contributions in the updated NDC” (Socialist Republic of Viet Nam, 2020, p. 34). From the Vietnamese perspective financial capacity as a developing country is limited when it comes to achieving high emissions reduction targets, and this is also reflected in the conditional target of the NDC. Vietnam is reliant on international support in order to effectively reduce GHG emissions.

Development of the energy sector and energy transitions are costly, as evident from the emphasis on international support and financing of the NDC and the energy master plans. The newest draft version of the PDP 8 states that the investment capital needed for selected power development program for the timeframe of 2021 to 2030 is estimated at approximately 99 – 116 billion USD. For the timeframe 2031 to 2045 the estimate is approximately 180 – 227 billion USD (Socialist Republic of Viet Nam, 2021). This estimate for the power sector entails the investment costs needed to develop the power sector to meet the increasing power demands. The next section looks at the third and final top-level variables of the political perspective.

4.1.3 Political interests

Political interests under the political perspective includes special interests such as industry lobbying etc. Since this thesis mostly uses documents written by Vietnam this section will focus mostly on Vietnam’s interests here. The state goals can also be seen as part of Vietnam’s interests in energy transition. The focus placed on international support in the Paris Agreement submissions can also be seen as part of Vietnam’s interests e.g., attracting international support in transitioning from fossil fuel to renewable energy. The next chapter on the techno-economic perspective uses not only documents from the Vietnamese perspective alone, but also Energy Outlook Reports created by the Vietnamese-Danish Energy Partnership Programme. Despite that the reports are not dominant in this chapter it is worth mentioning since they are parts of the documents in table 1 and it paints a picture of this international support Vietnam is highlighting in their Paris Agreement submissions. The reports are used mainly to gather data on the current energy situation as it related to the techno-economic perspective. The reports, done in

collaboration, can be seen as being written from both the Danish and Vietnamese perspective. It is therefore important to note that Denmark, which is a big player in wind power in the world with companies such as Vestas and Ørsted, also have their own interests in aiding in Vietnam's energy transition. Vestas opened a new corporate office in Ho Chi Minh City in 2022 (Vietnam Investment Review, 2022). Ørsted is present in Vietnam and present themselves as "committed to contribute to the country's green energy transition and support the development of the local offshore wind industry" (Ørsted, 2023). This can be seen as industrial lobbying under special interests as there are other players in energy transition aiming to take part in Vietnam's transition from fossil fuel to renewable energy. In chapter 6, which looks at the actors in the socio-technical energy system, we see that the biggest enterprises in the energy sector are state-owned. This also adds a layer to the factors of political interests under the political perspective. This will be further analyzed in chapter 6, but it worth mentioning here as the three-perspectives and its top variables influence each other.

In summary, Vietnam has put forth several state goals of ensuring energy security to meet their economic development goals and climate change mitigation, as well as the goal of net-zero emissions by 2050. These state goals are affecting energy policy in Vietnam. The role of international processes with the Paris Agreement and policy diffusion is recognized by Vietnam, as they highlight the need for harmonization of policies on the international and national level. As evident from the REDS, Resolution 55 and the evolution of the PDPs Vietnam has placed greater emphasis on renewable energy in their energy planning in recent years. However, as seen in table 3, coal is still a big part of Vietnam's power generation capacity. Regarding institutions and capacity, Vietnam signals the need to revise and upgrade their policy framework for mitigation in order to meet their goals of the Paris Agreement and subsequently transition from fossil fuel to renewable energy. Vietnam's capacity is limited, and Vietnam needs international support in order to meet their Paris Agreement commitments. Vietnam highlight in their NDC's the need for international support in terms of financing, technology transfer and capacity building and welcomes the international community to take part in assisting Vietnam in energy transition. The Vietnamese-Danish Energy Partnership Programme mentioned in section 4.1.3. can be seen as an example of this type of international support. The next chapter analyses and highlight important factors of the techno-economic perspective that influence both the political perspective

and the socio-technical perspective (chapter 6). By mapping the important factors of each perspective and understanding the co-evolving of these systems the aim is to gain an overview of the context of the ongoing energy transition.

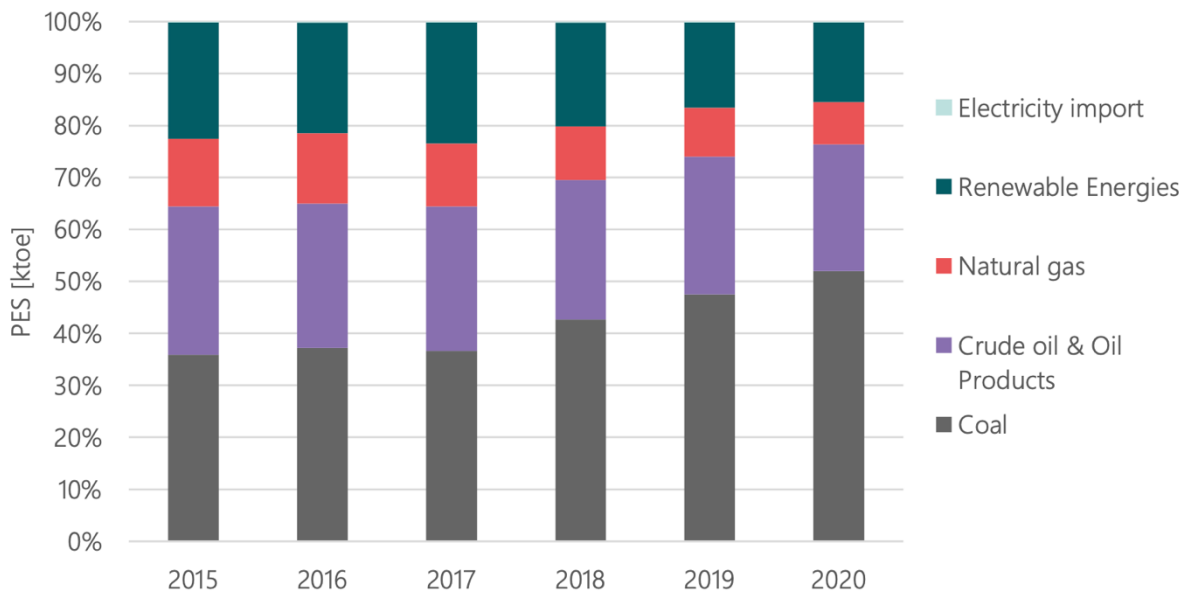
5. Techno-economic perspective on energy transition in Vietnam

This chapter presents an overview of the techno-economic factors influencing energy transition. The status of the energy sector was briefly introduced in chapter 1 but this section will look closer and analyze how these factors are presented from the Vietnamese perspective in influencing the ongoing energy transition. The aim is to highlight important factors influencing energy transition in Vietnam. By using the integrated framework, the aim is to understand how these factors might interact and influence the incumbent energy system and energy policy. The techno-economic factors might put the current energy system under pressure, or they might create opportunities. This chapter is based on the Vietnam Energy Outlook Reports from 2019 and 2021 (created by the Vietnamese-Danish Energy Partnership Programme), Resolution 55, the National Climate Change Strategy from 2022 and the NDC from 2022. The energy outlook reports by the Vietnamese-Danish Energy Partnership Programme are here mainly used to gather data on the current energy situation. The chapter is structured using the top-level variables energy resources, energy demand, and energy infrastructure.

5.1 Energy resources

Under the techno-economic variable of energy resources the theoretical framework highlights important secondary variables such as fossil fuel types, resources and reserves, import and export of fuels and the potential for renewable energy. **Figure 2** below presents the fuel share of primary energy supply from 2015 to 2020 and shows that the energy mix is dominated by fossil fuels. Coal has the largest share in the energy mix followed by crude oil and natural gas. The figure depicts increased fossil fuel dependency with particularly increased coal dependency. Fuel diversification has decreased with the focus being mainly on coal. Coal increased its share in the energy mix significantly from 28% in 2010 to 35% in 2015 to over 50% in 2020 (EREA & DEA, 2022). Hydropower is the biggest renewable fuel source, but hydropower has decreased its share in the energy mix. The hydro power potential is almost fully utilized which is why predictions suggest fossil fuels to significantly increase its share unless Vietnam accelerates its transition to non-hydro renewable energy (EREA & DEA, 2019).

Figure 2: Share of primary energy supply 2015 – 2020 (EREA & DEA, 2022).



Vietnam is rich in energy, from both conventional and non-conventional sources. Vietnam has significant fossil fuel resources and reserves and is producing coal, natural gas and crude oil. At the current reserve/extraction rate the resources are expected to last 70 years (coal), 45 years (natural gas) and 18 years (crude oil) (EREA & DEA, 2022). Vietnam has large coal reserves in the North, but domestic exploitation of coal has experienced both technical and economic challenges resulting in supply bounds. While the middle-scale and large-scale hydropower capacity is nearly fully utilized, about half of the country’s small-scale hydropower capacity is untapped (EREA & DEA, 2022; EREA & DEA, 2019). Vietnam has a coastline of 3,260km and a large potential for offshore wind power as well as a great potential for solar power (EREA & DEA, 2022).

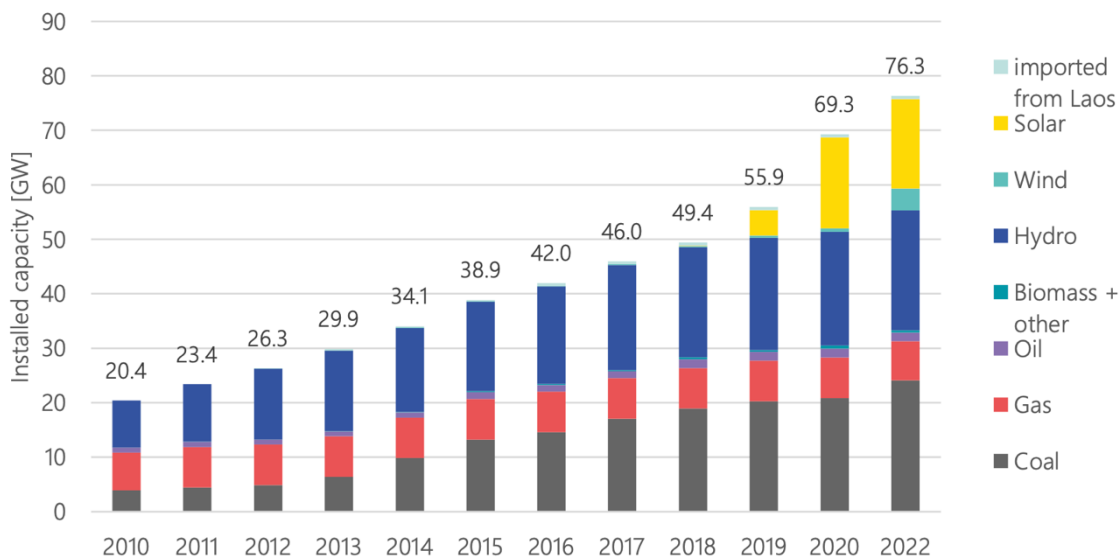
The global climate change agenda with the Paris Agreement and the government’s state goal of net-zero emissions by 2050 as analyzed in chapter 4 can be seen as according to the theoretical framework as pressuring the current energy system dependent on fossil fuel, and particularly coal. This can also be seen as external landscape pressures in the MLP framework that can destabilize an energy regime. Meaning that these pressures can hinder business-as-usual fossil

fuel development of the energy sector, and that these pressures can result in the un-locking of the fossil fuel system to allow for an alternative. Vietnam's great potential for renewable energy is an important factor creating great opportunities for Vietnam in their transition pathway as the current fossil fuel system is experiencing pressures to change. Development and utilization of Vietnam's renewable energy potential can increase domestic energy security by diversifying the energy mix and reducing fuel imports. Vietnam's challenges of import dependence will be analyzed further in section 5.1.1.

The Vietnam Energy Outlook Report 2021 looks at a net-zero scenario by 2050 as it was announced by the Prime Minister at COP26 (Socialist Republic of Viet Nam, 2022; EREA & DEA, 2022). The net-zero pledge marks an important shift in the development of the Vietnamese economy and the energy sector. To reach the net-zero emissions target with the least cost renewable electricity should be the main replacement for fossil fuel. The analysis in the report uses a baseline scenario (BSL) which is the reference scenario of "existing policies and contracted commissioning of new plants" with a committed generation capacity of the power sector that follows the proposed PDP 8 until 2026 and no new coal from 2035 (ERE A & DEA, 2022, p. 23). The electrification needed to reach the net-zero target will result in electricity consumption to more than double in 2050 compared to the BSL. The power system must supply more than 70% of total final energy demand with renewable electricity in 2050 to reach the target. The net-zero target is composed of 47% storage, 43% solar, and 7% wind (p. 3). Replacing fossil fuels with renewable electricity will require at least 2,200 GW of power generation capacity including storage by 2050. This is four times higher than the BSL scenario and 30 times higher than current installed capacity. Vietnam has currently about 24 GW of coal-fired power plants in operation. An additional 6 GW are already in construction and a further 7 GW have "signed contracts but due to challenges in financing, they are not considered as committed" (p. 5) by the 2021 report. To stay on the net-zero pathway according to the analysis, Vietnam is recommended to stop building new coal-fired power plants except what it already committed. Additionally, Vietnam should phase out coal-fired power plants sooner than their technical lifetime. Furthermore, to be able to meet the net-zero target without excessive costs emissions should peak no later than 2035 (ERE A & DEA, 2022, pp. 3-5). This is an impressive target for

Vietnam, who in the BSL scenario will see emissions increase more than twofold in 2050 compared to 2020 levels (EREA & DEA, 2022, p. 30).

Figure 3: Historically installed capacity for electricity generation by source from 2010 to 2022 (EREA & DEA, 2022).



Replacing fossil fuels with renewable electricity while at the same time expanding supply and generation capacity as Vietnam continues to develop is not an easy task. Vietnam’s net-zero emissions target and the pathway proposed by the Energy Outlook Report 2021 are presenting a pathway for Vietnam to break the path dependency of fossil fuel development. However, this raises the question of how difficult this would be for a developing country like Vietnam. **Figure 3** shows Vietnam’s historically installed capacity for electricity generation by source from 2010 to 2022. The figure show that the country’s power generation has been dominated by coal, natural gas and hydro. But since 2019 Vietnam has seen success with solar and wind. With the help of Feed-in-tariffs (FIT) Vietnam accelerated its renewable energy development and installed 16.5 GW of solar power and 4 GW of wind power in about 4 years (EREA & DEA, 2022, p. 53). The figure depicts a country in transition and the year 2019 marks a significant shift in the country’s power development. As seen in table 3 and 4 in chapter 4 Vietnam saw a policy shift in their

power development planning starting in 2016 when they revised the plan earlier than expected and increased the non-hydro renewable targets. The success with solar and wind shows that Vietnam has been able to start to un-lock the fossil fuel system.

For Vietnam to meet its net-zero target by 2050 the success of non-hydro renewables needs to continue. Resolution 55 (before the net-zero target was announced) highlight the need for energy security. Regarding coal, they state to create a roadmap to reduce the share of coal-fired power and to prioritize development of renewable energies. Resolution 55 does however see fossil fuels increase as well, as the system is currently dependent on fossil fuels (Socialist Republic of Viet Nam, 2020B). As seen in section 4.1.2.1.2, according to the draft version of the PDP 8, Vietnam is expanding of the coal fleet to meet the growing demand for energy (as predicted in the Energy Outlook Report 2019). Resolution 55 signal an increased focus on renewable energy and decarbonization of the energy sector. However, they also signal the continued need for coal power. They state to develop “coal-fired thermal power development at a reasonable level” (p. 7) with modern technologies of high efficiency and to upgrade existing power plants to meet environmental protection requirements and decommission power plants that does not meet regulations (Socialist Republic of Viet Nam, 2020B). This can be seen in line with Vietnam’s pledge to move away from unabated coal power as seen in chapter 4 under the role of international processes. The newest Climate Change Strategy from 2022 state that emission should peak at 2035 and reduce rapidly from there (Climate Change Laws of the World, 2023). This is in line with the recommendations of the Vietnam Energy Outlook report 2021.

5.1.1 Coal: Import dependence and global coal phase out

The demand for energy is growing faster than the economy and the annual extraction rates are not able to meet the growing demand. Vietnam has historically been a net exporter of energy, but in 2015 this changed, and Vietnam became a net importer of energy. In 2020 approximately 1/3 of the total primary energy supply (TPES) was imported (EREA & DEA, 2022; EREA & DEA, 2019). The Energy Outlook Reports from both 2019 and 2021 finds that imports will increase the coming years. As a result of the rapidly increasing energy demands and challenges of supply bounds. And due to the fact that imported fossil fuels are sometimes cheaper than costs related to domestic production and that power plants tend to choose the cheapest option (EREA & DEA,

2022). Regarding the state of import dependence Vietnam in Resolution 55 highlight that the energy sector still faces many challenges with national energy security as domestic supply does not meet demand which then leads to increasing imports (Socialist Republic of Viet Nam, 2020B). While they recognize to challenge of import dependence and importance of diversification they also state to develop “a novel development strategy for the coal sector in agreement with the mission of efficient investment in overseas activities and coal imports in the long run” (p. 6). Stating the continued need for coal imports to ensure fulfillment of requirements of production activities, particularly for power generation. Vietnam’s increasing dependence on imported coal can according to the theoretical framework be seen as putting pressure on the existing energy system. The global coal phase down/out with the Global Coal to Clean Power Transition Statement in which Vietnam is a signatory can also put pressure on the energy system dependent on coal. Pressures can also come from the system itself as the system in not able to adequately provide energy security due to supply bounds resulting in increasing imports.

5.2 Energy demand

Energy demand is the second variable under the techno-economic perspective and an important secondary variable here are the drivers of demand. As seen in the introductory chapter of this thesis Vietnam has in the last decades seen impressive economic growth on their development path. Regarding energy consumption Resolution 55 highlight that consumption has increased significantly in line with the change in composition of energy consumption towards industrialization (Socialist Republic of Viet Nam, 2020B). The Vietnam Energy Outlook Report from 2019 identify the main drivers of the growing demand as; increased economic activity, urbanization, industrial development, increased transport demands, improved energy access and rising living standards (EREA & DEA, 2019). The drivers of energy demand are important techno-economic factors influencing the current energy system in Vietnam as energy security is of critical importance for a developing country seeking to meet their socio-economic development goals. As seen in section 4.1.1.2. Vietnam aims for continued strong economic growth the coming decades and will see the demand for energy continue to increase. Vietnam’s future energy orientations (Resolution 55 and its Action Programme) states total installed capacity of power sources to reach 125 – 130 GW by 2030 (Socialist Republic of Viet Nam, 2020B; Socialist Republic of Viet Nam, 2020A). Here Vietnam is seeking to nearly double its

generation capacity from the 76.3 GW installed capacity in 2020 (as seen in table 3) in under ten years. Also considering their net-zero emissions target by 2050 which as recommended by the Energy Outlook Report 2021 is to be met with direct electrification which will see power generation increase significantly.

5.3 Energy Infrastructure

Energy infrastructure is the last of the three main variables under the techno-economic perspective. Under this variable the framework presents the following secondary variables; existing infrastructure for extraction, transportation, conversion and use as well as age of this infrastructure. The Politburo in Resolution 55 state that the existing energy infrastructure is “still incomplete and lacks uniformity” (p. 2). One of their overall objectives in the resolution is to “develop the energy sector harmoniously among sub-sectors with complete and smart infrastructure, reaching the advanced level of ASEAN (p. 4). Regarding the transmission grid they state the need to “invest in the modernization of the power sector in the production, transmission, distribution phases to meet the development requirements of the power market with strong capability to integrate a large amount of renewable energy” (Socialist Republic of Viet Nam, 2020B, p. 8). As seen above, Vietnam’s power sector has historically been dominated by fossil fuels and most of the existing infrastructure is consequently developed for fossil fuels. In Vietnam’s NDC from 2022 they state it a challenge in GHG mitigation that “the power grid for integrating and transmitting renewable energy sources has lagged behind the rate of source construction, limiting the system’s output of clean electricity and posing risk to investors” (Socialist Republic of Viet Nam, 2022, p. 34). Regarding the limitation of the national transmission grid Resolution 55 states to “break down the monopoly and unsuitable barriers against the usage of energy facilities and service infrastructure; develop mechanisms and policies on investment in the development of the power transmission system and separate from the state monopoly in power transmission (Socialist Republic of Viet Nam, 2020B, p. 9). “To break down the monopoly” are strong words and signals further focus and emphasis on privatization of the power sector and transmission system. The state of the country’s energy infrastructure e.g., the limited capacity of the national transmission grid with regards to renewable energy generation is an important techno-economic factor affecting Vietnam’s ability to transition to renewable energy. Highlighting the co-evolution of systems as the energy infrastructure of the techno-

economic perspective needs to co-evolve with technological changes of the socio-technical perspective e.g., technology diffusion of solar and wind, with the co-evolving of energy policies and institutions of the political perspective.

To summarize, this chapter paints a picture of an energy system dependent on fossil fuels and a country which is rich in both fossil fuel and renewable energy sources. But due to domestic supply challenges, Vietnam has become dependent on imported fossil fuels, particularly coal, and is currently a net importer of energy. Vietnam's demand for energy is increasing faster than the domestic energy sector can keep up and this is threatening national energy security. Vietnam's increasing energy demands are in line with the country's high development path of industrialization. This chapter also paints a picture of an expanding energy system both in terms of supply, as Vietnam seeks to boost domestic supply both in fossil fuel and renewable energy, and in infrastructure. The incomplete infrastructure of the transmission grid and the bottlenecks Vietnam is experiencing threatens future investments in renewable energy as the grid is not able to handle the level of success with solar and wind. This is a challenge for the ongoing energy transition. In chapter 4 under section 4.1.2.1.2 Policy shifts in Power Development Plans, the question asked was why the planning in PDP 8 draft version did not keep up the momentum of recent solar and wind success. The lacking infrastructure and grid highlighted in this chapter can be one explanation for this. The grid simply cannot handle a greater surge in non-hydro renewables just yet, pressuring the system to expand to accompany for the changes in energy policy which places greater emphasis on renewable energy. Resolution 55, as seen in the section 5.3, highlight the need to reform the sector to encourage private sector participation in power transmission system. Further developing the transmission grid to meet the changes in energy policy can further un-lock the system to increase renewable energy development. The next chapter will map and analyze the socio-technical actors within the socio-technical energy system in Vietnam in addition to analyze Vietnam's position on technology diffusion/transfer and innovation systems to complete the three-perspectives framework.

6. Socio-technical perspective on energy transition in Vietnam

This chapter using the socio-technical perspective will analyze the energy regime and niches and looks at the socio-technical actors. This section will present an overview of the actors of the ongoing energy transition in Vietnam as presented from the Vietnamese perspective. It will also give an overview of Vietnam's perspective on technology diffusion and innovations systems. The aim is to understand the socio-technical factors of pressures both from landscape factors as well as from the energy regime itself, that influence the sector which in turn might influence energy policy. This chapter uses most of the documents in table 1 to map the actors in the ongoing energy transition. The chapter is organized using the top-level variables regimes and niches, technology diffusion and innovation systems.

6.1 Regimes and Niches: Incumbent and niche actors

Since Vietnam is a country in development the energy system can be categorized as an expanding energy system according to the theoretical framework. In the draft version of the upcoming power plan they state to “accelerate the program for power supply for rural, mountainous and island areas for the 2021-2030 period to reach the target of supplying power for 100% household” (Socialist Republic of Viet Nam, 2021, p. 3) signaling that the power system is expanding. Additionally, the state goal of ensuring national energy security to meet their socio-economic development goals in line with industrialization is painting a picture of an expanding energy system in both coverage and in generation capacity. The challenges with transmission grid bottlenecks as seen in section 5.3 also portrays the picture of an expanding system as the infrastructure needs to develop to accompany renewable energy development.

According to the framework socio-technical transitions does not occur in a vacuum. Socio-technical system are embedded systems in the context in which transitions occur and according to the three-perspectives framework involves the co-evolving of several systems. Both the techno-economic- and political factors influence the socio-technical system and subsequently influence a transition. The techno-economic factors of increasing import dependance, the fossil fuel dependency, rising energy demands, and the lacking infrastructure are putting pressure on the existing energy system. Since the incumbent energy system is dominated by fossil fuels the actors within the fossil fuel system can according to the framework be seen as incumbent actors. The

actors in non-hydro renewable energy, which until recently were almost non-existent can be seen as the niche actors that is pressuring the incumbent fossil fuel system and its actors. The state goals of energy security, low carbon development and the net-zero emissions target can according to the MLP framework on the socio-technical system be seen as landscape factors putting pressure on the incumbent system. Changes in state goals and subsequently policy changes can be seen in connection to the role of international processes and policy diffusion resulting from the global agenda of climate change mitigation e.g., the Paris Agreement. Pressures on the incumbent system and its actors can according to the framework also come from within the system itself. In this regard the challenges of lack of infrastructure and transmission bottlenecks can be seen as such internal pressures.

This thesis focuses on the ongoing national energy transition in Vietnam which is broad in scope and not focused on a specific sector, therefore the focus on regimes and niches will attempt to present the main actors in this transition as highlighted from the Vietnamese perspective. Since this thesis uses mostly Vietnamese policy and strategy documents, the actors found are mostly under the government apparatus. The state can be seen as an actor under both the socio-technical and the political perspective as it gives direction on future energy development and as Vietnam's main incumbent energy companies are state owned. **Table 5** presents an overview of the actors in energy transition presented in the documents. The selection of actors presented in table 5 started with the main actors mentioned in policy documents on energy as well as the PDPs which specifically mention the state-owned enterprises (SOE) and the line ministers with their respective responsibilities. The next step was then to look at the Paris Agreement submissions to include the main implementing actors as this relates to the ongoing energy transition, as well as the international community as Vietnam highlights the need for international support. There are several other actors mentioned in the documents in table 1 but not all of them are included as the aim was to present the main actors.

Table 5: Overview of actors in energy transition.

Actors	Type of actor	Responsibility	Incumbent or niche
The Government (CPV, President, Prime Minister, Politburo & Central Committee of the CPV)	State	Executive power – ensuring national energy security to meet socio-economic development goals.	
National Steering Committee for Implementing Viet Nam’s Commitments at COP26	State	Executive – NDC implementation.	
National Assembly	State	Legislative	
Ministry of Industry and Trade	State	Energy sector management: Development and implementation of PDP. SOE energy reform and restructuring.	
Ministry of Natural Resources and Environment	State	NDC implementation, monitoring, evaluating & reporting. Identify and assess fossil fuel reserves and potential as well as RE sources.	
Ministry of Planning and Investment	State	SOE energy reform and restructuring. Review legal documents on investment environment; incentives private sector participation; acceleration in energy development by removing barriers. Prioritize investments in sustainable energy infrastructure. Incentivize energy investments of PPP model.	
Ministry of Finance	State	SOE energy reform and restructuring. Mobilize private investment capital. Incentivize energy investments of PPP model. Incentivize investment in RE by fiscal policy.	

Vietnam Electricity w/subsidiaries	SOE	Production, transmission, distribution and trading of electricity.	Incumbent
Vietnam Oil and Gas Group w/subsidiaries	SOE	Oil and gas exploration and production. LNG infrastructure for imports.	Incumbent
Vietnam National Coal-Mineral Corporation w/subsidiaries	SOE	Coal and mineral mining – supply of domestic and imported coal sources.	Incumbent
IPP & BOT projects fossil fuels	Private entities	Power supply	Incumbent
IPP & BOT projects hydro	Private entities	Power supply	
IPP & BOT projects non-hydro renewables energy	Private entities	Power supply	Niche
Coal exporting countries	Private entities	Business	Incumbent
International community	Developed states e.g. Denmark, private investment, financial institutions, Intl. org., NGO's etc.	Technological and financial support and capacity building for mitigation – energy transition.	

Notes: CPV: Communist Party of Vietnam; NDC: National Determined Contributions; PDP: Power Development Plans; PPP: Public-Private-Partnership; SOE: State-Owned Enterprise; LNG: Liquefied Natural Gas; IPP: Independent Power Producer; BOT: Build-Operate-Transfer.

The CPV and the government with the National Assembly, the Central Committee of the CPV, the Politburo, The President and the Prime Minister are all central government actors in the ongoing energy transition. The Politburo, which serves as the highest body of the CPV, gave directions on future energy development with Resolution 55 in 2020. The resolution orients future energy development strategies, plans and programs to be formulated by the responsible line ministries (Socialist Republic of Viet Nam, 2020B). Ministry of Industry and Trade (MOIT) is responsible for energy sector development and is an important actor in the ongoing energy transition. Since Vietnam's commitments under the Paris Agreement with their NDC and mitigation targets is closely linked to the ongoing energy transition actors in NDC implementation is also included here. The ministry of Natural Resources and Environment (MONRE) is the lead ministry responsible for NDC implementation and reporting. After COP26 Vietnam established the National Steering Committee for Implementation of their NDC

commitments which is headed by the Prime Minister to accelerate implementation (Socialist Republic of Viet Nam, 2022). Ministry of Planning and Investment (MPI) and Ministry of Finance (MOF) are also important actors in the ongoing energy transition. MPI is tasked in Resolution 55 to further improve the investment environment by reviewing laws on foreign investment to remove barriers and incentivize private sector participation and investment in energy development. The resolution also states to prioritize investment in sustainable energy infrastructure. MOF is tasked with mobilizing private investment capital with fiscal tax policies to particularly incentivize renewable energy development. Both MPI and MOF is stated to particularly incentivize energy investments using the Public-Private-Partnership (PPP) model (Socialist Republic of Viet Nam, 2020B).

Vietnam Electricity (EVN), Vietnam Oil and Gas Group (referred to in the documents as both PetroVietnam and PVN) and Vietnam National Coal-Mineral Corporation (Vinacomin) and their subsidiaries are important incumbent actors in the current energy system as SOE. In Resolution 55 (2020B) Vietnam highlight SOE as the main actors in the energy sector. EVN, Vietnam Oil and Gas Group and Vinacomin are not specifically mentioned by name in the resolution, but is mentioned in the Power Development Plans from 2011, 2016 and the draft version from 2021 (Socialist Republic of Viet Nam, 2011; Socialist Republic of Viet Nam, 2016A; Socialist Republic of Viet Nam, 2021). As seen in table 5, EVN is the main actor in electricity production, transmission and distribution and EVN is currently the sole financier of the transmission grid (EREA & DEA, 2022). Vietnam Oil and Gas Group is the main actor in oil and gas exploration and production. Vinacomin is the main actor in coal mining and tasked with responsibility of coal supply from both domestic and imported sources. The incumbent actors of the current system, the SOEs, are undergoing reform and restructuring (Socialist Republic of Viet Nam, 2020B).

Vietnam in their NDC (2022) states it a challenge to GHG emissions reduction that the “competitive energy market has not developed synchronously” (p. 34) indicating an unfair advantage of some actors in the energy market. This is also highlighted in Resolution 55 where the Politburo state to aspire “to develop the national energy system in line with the socialist-oriented market economy and international integration trend; quickly develop a synchronous, competitive and transparent energy market” (p. 3) and “resolutely eliminate all subsidies, monopoly, unfair competition and the lack of transparency in the energy sector” (Socialist

Republic of Viet Nam, 2020B, p. 3). Furthermore, Resolution 55, aims to restructure the SOEs in the energy sector as to focus on their respective advantage within their core sector and to further accelerate the equitization i.e., privatization of SOEs in the power sector. Additionally, to remove barriers of private sector participation and to increase transparency (Socialist Republic of Viet Nam, 2020B). MOIT, MPI and MOF in the Government Action Programme for implementing Resolution 55 is also tasked with restructuring and reforming the SOEs in the energy sector to increase performance and to promote “private sector’s involvement in socialization for energy development” (Socialist Republic of Viet Nam, 2020A, p. 12). As briefly mentioned in section 5.3 under political interest, as the SOEs are state owned Vietnam has interests in these enterprises and states in resolution 55 that the energy sector is transforming with SOE being the core actors (Socialist Republic of Viet Nam, 2020B). Signaling that even though the sector is reforming and undergoing equitization in the power sector and transmission to increase performance and RE development the SOEs will continue to be the core actors.

This SOE restructuring and reform in the energy sector can be seen in relation to Vietnam’s need for international support. As seen in chapter 4 under the political perspective Vietnam highlights in their NDC the need for international support in both capacity building, technology transfer and financing as well as private sectors participation both from domestic and international sources in order to meet their emissions reduction targets (Socialist Republic of Viet Nam, 2022).

Additionally, the focus in Resolution 55 on improving the mechanism and schemes to incentivize private sector participation in renewable energy development portrays a picture of an energy transition pathway that is dependent on international support. Therefore, as seen in table 5, the international community is added as an actor in the ongoing energy transition. According to the theoretical framework energy transitions does not occur in a vacuum as energy systems are imbedded in the overall context i.e., landscape in which the transition occurs. The global climate change agenda is putting pressure on fossil fuels energy systems worldwide and can be seen as a landscape pressure. The Vietnamese-Danish Energy Partnership Programme (The Energy Outlook Reports) can be seen as this type of international support and is therefore added in table 5 under international community.

Table 5 shows the main actors in the energy system are SOEs in the fossil fuel industry. According to the framework, a socio-technical system, creates path-dependance and lock-in due to the large investments in technology, infrastructure, and the institutional structures of that system. Vietnam's energy system is path-dependent and locked-in on fossil fuels as the energy sector is currently dependent on fossil fuels as seen in chapter 5. Vietnam has in recent years been able to start to un-lock the fossil fuel energy system, as they have had success with solar- and wind power. Challenges still exists in this un-locking of the current fossil fuel system. This was highlighted in chapter 5 under infrastructure where the current energy grid is experiencing bottlenecks and not able to handle the level of renewable power produced (Socialist Republic of Viet Nam, 2022). As seen in table 5, non-hydro renewables power projects, solar and wind, are also actors in the ongoing energy transition. Soler and wind power projects are owned by private entities as either Independent-Power-Producers (IPPs) or Build-Operate-Transfer (BOT) models. These can according to the theoretical framework be seen as niche actors. As seen in table 5, Vietnam also has IPPs and BOTs in fossil fuels. These actors are in this thesis seen as incumbent actors as well because of the use of fossil fuels in a setting of a transition to renewable energy sources. The IPPs and BOTs in hydropower is not categorized as either incumbent or niche as Vietnam has almost fully utilized its hydropower potential as seen in chapter 5. Table 5 also includes coal exporting countries as actors in the ongoing energy transition as Vietnam currently is dependent on coal imports, as seen in chapter 5, and since Vietnam states in its Resolution 55 and draft version of PDP 8 the need to for coal import in the future (Socialist Republic of Viet Nam, 2020B; Socialist Republic of Viet Nam, 2021).

To summarize this section on regimes and niches from the Vietnamese perspective. The Politburo in Resolution 55 states that Vietnam's energy system i.e., incumbent energy actors and particularly the power sector has seen rapid development the last 15 years and achieved the overall targets and orientations. The sector is currently undergoing transformation to market mechanism to increase performance and accelerate development with SOEs as central actors. However, they recognize the challenges in ensuring national energy security and the need to accelerate renewable energy development. Resolution 55 places increased focus on renewable energy development and aims to increase and accelerate the investment in renewable energy projects by easing the regulatory framework and by economic restructuring of the energy sector

and market (Socialist Republic of Viet Nam, 2020B). Vietnam in their energy plans and strategies welcomes niche actors in form of private sector participation in renewable energy development and renewable energy infrastructure development (Socialist Republic of Viet Nam, 2020B; Socialist Republic of Viet Nam, 2020A; Socialist Republic of Viet Nam, 2021)

6.2 Innovation systems

Innovation systems is the second variable under the socio-technical perspective. Secondary variables here are the presence of national, sectoral and technological innovation systems and their performance with e.g., Research and Development (R&D). Under support for NDC implementation Vietnam highlight the need for R&D with regards to the ongoing energy transition. They state “assist Viet Nam in strengthening its research and development (R&D) capacity in order to achieve scientific and technological autonomy in climate change response and energy transition” (p. 36). More specifically they highlight R&D on GHG emission reduction technologies such as to reduce methane leakage in fossil fuel extraction, energy efficiency and storage, carbon capture, use and storage in coal power plants and technology to “increase flexibility of thermal power sources to operate more efficiently using renewable energy sources” (Socialist Republic of Viet Nam, 2022, pp. 36-37).

The need to promote innovation and R&D is also highlighted in both of the Green Growth Strategies from 2012 and 2021 (Socialist Republic of Viet Nam, 2012; Socialist Republic of Viet Nam, 2021). In the REDS from 2015 Vietnam states to “promote and encourage RE-related R&D activities among scientific and technical research organizations” (Socialist Republic of Viet Nam, 2015, p. 10). Resolution 55 from 2020 puts greater emphasis on innovation and R&D with one of the ten missions presented states to “develop science and technology and training high-quality human resources for the energy sector” (Socialist Republic of Viet Nam, 2020B, p. 12). Here they state to establish innovation centers in the energy sector, integrate R&D activities into future energy development plans and strategies and to develop a master policy on human resource development and training programs (Socialist Republic of Viet Nam, 2020B). The resolution’s Action Programme tasks the Ministry of Science and Technology with the development and implementation of a national program for R&D and application of energy technology for the period 2021 to 2030 (Socialist Republic of Viet Nam, 2020A). The focus of the national program

is said in Resolution 55 to be “producing energy equipment; apply new, renewable energy, smart energy and saving energy” (Socialist Republic of Viet Nam, 2020B, p. 12). Vietnam recognizes the need for innovation and R&D in energy development and particularly renewable energy as highlighted in the REDS, Green Growth Strategies, Resolution 55 and its Action Programme. Resolution 55 from 2020, sets out to establish innovation centers and accelerate R&D activities. This paints a picture of innovation systems in the energy sector as novel and not fully established. The resolution does not specify renewable innovation centers, however as the focus of the national program on R&D is renewable energy and as highlighted in their NDC, it is a positive signal for the ongoing energy transition. The establishment of energy sector innovation centers is according to the theoretical framework and important factor in energy transition.

6.3 Technology diffusion

Technology diffusion or transfer is the third variable of the socio-technical perspective. Technology diffusion of non-hydro renewable energy is an important factor for Vietnam’s transition pathway. This section analyzes Vietnam’s perspective on technology diffusion. The REDS from 2015 placed emphasis on stronger international cooperation in renewable energy as a solution for the implementation of the strategy. Furthermore, international cooperation as a tool to “attract more capital sources and promote technology transfer” (p. 11) in the development of renewable energy (Socialist Republic of Viet Nam, 2015). Vietnam in their newest NDC from 2022 highlight cooperation and support from the international community to reach their net-zero target. Particularly from developed countries, both in terms of finance and technology transfer (Socialist Republic of Viet Nam, 2022). Additionally, they state that since Vietnam is lagging the global average on technology production, the country is in high demand for research and technology transfer (p. 35). This is argued by Vietnam as a challenge in NDC implementation. This is in line with the world systems theory as seen under the theoretical framework where technology arises in the core and diffuses to the periphery. Under the measures to implement the NDC they state the need to promote technology transfer in the following sectors:

Transition to clean energy production, economical and efficient energy consumption; usage of new, low emission, environmental friendly fuels and materials, carbon capture and storage; efficient exploitation and management of resources; development and adoption of renewable energy; new energy and energy storage; efficient exploitation and

management of resources; development and adoption of renewable energy; new energy and energy storage;... (Socialist Republic of Viet Nam, 2022, p. 29)

The statement above from Vietnam regarding technology transfer and in the several areas paints a picture of an urgent need for international cooperation in Vietnam's energy transition pathway. The need to carry out technology transfer is also mentioned in the newest Green Growth Strategy from 2021 under the section regarding international integration and cooperation (Socialist Republic of Viet Nam, 2021). Technology transfer is also highlighted in the development of the power sector in the draft version of PDP 8 with regards to international cooperation (Socialist Republic of Viet Nam, 2021). The focus on international support and technology transfer in Vietnam's NDC, Green Growth Strategy 2021 and Draft of PDP 8 highlight the need for international cooperation on the transition pathway as the country's capacity on its own is limited. This is aligned with the need for support in financing as highlighted under institutions and capacities in chapter 4.

The level of global maturity of relevant renewable energy technology to replace fossil fuel technologies is an important secondary variable under the theoretical framework. Vietnam in their newest NDC recognize the need to shift to renewable energy and low carbon technology in order to reduce emissions. However, they highlight it as a challenge to NDC implementation that renewable energy technology and low carbon technology "is still expensive or incomplete" (p. 34) Furthermore they state that "the cost of solar and wind energies have decreased rapidly in recent times but are not stable due to their dependance on weather conditions and daylight (Socialist Republic of Viet Nam, 2022, p. 34). Vietnam has however been able to develop both solar and wind power in recent years as seen in figure 3. The technology diffusion of renewable energies such as solar and wind in Vietnam are important socio-technical factors influencing energy transition. The analysis in chapter 4, 5, and 6 presents several different perspective and factors, under the three-perspective framework on national energy transitions by Cherp et al (2018) that influence Vietnam's energy transition pathway. To bring all the information provided in these chapters together to present an overview of the situation the next chapter will summaries the findings and highlight important factors.

7. Summary of findings

Table 6 summarizes the findings of this research to present an overview of Vietnam’s perspective on the political, - techno-economic, - and socio-technical factors that influence the transition from a fossil fuels energy system to a renewable energy system. The three perspectives framework conceptualize energy transitions as the co-evolving of the three systems (Cherp, Vinichenko, Jewell, Brutschin, & Sovacool, 2018).

Table 6: Overview of the political-, techno-economic- and socio-technical factors influencing energy transition from the Vietnamese perspective.

Techno-economic factors	Socio-technical factors	Political factors
<p>Resources:</p> <ul style="list-style-type: none"> - Fossil fuel dependence, coal for power generation - Domestic supply not meeting demand - Import dependence - Great potential for solar and wind 	<p>Innovation Systems:</p> <ul style="list-style-type: none"> - Aim to establish energy sector innovation centers - Aim to develop national program for R&D and application of renewable energy. 	<p>State goals:</p> <ul style="list-style-type: none"> - Low-carbon development - Net-zero emission by 2050 - Energy security - Strong economic growth, annual GDP growth of about 6 percent to 2045.
<p>Demand:</p> <ul style="list-style-type: none"> - Industrialization and socio-economic development driving demand. - Demand for energy and electricity will increase substantially in the future. 	<p>Regimes and niches:</p> <ul style="list-style-type: none"> - Expanding energy system - SOEs as main incumbent actors (EVN, PetroVietnam & Vinacomin). - EVN monopoly on transmission grid - IPP & BOT in solar and wind as niche actors. - SOE reform and restructuring-equitization - Socialization of energy - need to attract private sector participation. 	<p>Institutions and capacities:</p> <ul style="list-style-type: none"> - Paris Agreement - Revising institutions and policies - Limited state capacity - energy transition is costly; Vietnam cannot bear the cost alone. - Lower middle-income country. - International support in financing, technology and capacity building. - Highlight global financial flow to shift to low-carbon development.

		<ul style="list-style-type: none"> - Harmonization of policies on the national and international level. - Increased emphasis on renewables in energy policies, strategies and plans e.g., power planning.
<p>Infrastructure:</p> <ul style="list-style-type: none"> -Transmission grid lacks uniformity and is incomplete - Bottlenecks in integration and transmission of renewable power 	<p>Technology diffusion:</p> <ul style="list-style-type: none"> - Recent success with solar and wind - Recognize the importance and need for diffusion of renewable energy technology. 	<p>Political interests:</p> <ul style="list-style-type: none"> - State goals can also be placed here. - Attract international support - Danish wind companies (industrial lobbying) - State owned fossil fuel companies, Vietnam’s interests also lie here.

Table 6 present several important factors under each perspective and is quite extensive. The table paints a picture of the complexity of an energy transition as highlighted from the Vietnamese perspective. Under the techno-economic perspective, Vietnam has great potential for solar and wind power and has had recent success in solar and wind development. However, the energy system is dependent on fossil fuels and has become a net-importer of fuels as domestic supply is not able to meet the growing energy demands in the rapidly growing economy. Vietnam is experiencing bottlenecks in the transmission grid with regards to renewable power, as more renewable power is produced than the current grid can handle. The limited capacity of the transmission grid is a techno-economic factors that needs to be addressed for Vietnam to increase the development of renewable energy. Vietnam has political factors that both accelerate the transition but also factors that hinder the transition. Vietnam’s state goal of net-zero emissions by 2050 and the increased emphasis on renewable energy development, especially in the power sector are important contributing factors to the ongoing energy transition. However, as Vietnam is also a lower middle-income developing country seeking strong economic growth with limited domestic resources Vietnam needs international support in terms of financing, technology and capacity building. Going forward this section will highlight factors that portray the co-evolving of systems going across perspectives.

Energy transition in Vietnam, a developing country seeking continued strong economic growth and national energy security in an expanding energy system currently dependent on fossil fuels and imports paints a picture of a transition coinciding with the development of the energy sector. Vietnam will have to expand energy supply to meet the demands of industrialization while at the same time increase the share of renewables and decrease the share of fossil fuels in order to reduce emissions. Vietnam is balancing the need to ensure national energy security with climate change mitigation in a fossil fuel energy system. This signals, as the theoretical framework highlight, that an energy transition in a developed context and energy transition in a developing context differ. Energy systems in the developing context are emergent systems in that they are expanding in coverage and generation compared to consolidated systems where generation is constant or decreasing as argued by Israel and Herrera (2020).

Under the political perspective with international processes such as the Paris Agreement the theory of policy diffusion is highlighted. This is evident from the Vietnamese perspective with their NDC commitments, the net-zero emissions target, and increased focus on transitioning away from fossil fuels. Additionally, Vietnam highlight the need and benefit of harmonization of policies on the national and international level. These political factors both influence and are influenced by the techno-economic- and socio-technical factors. Under the socio-technical perspective we see an expanding energy system with state-owned enterprises (SOE) within fossil fuels and the national transmission grid as the main incumbent actors. Up until recently Vietnam had few niche actors in solar and wind but this has changed recently with a surge in power projects under Independent-Power-Producers and Build-Operate-Transfer models. Technology diffusion of renewable energy is an important factor of the theoretical framework in order to break or un-lock the path dependance of fossil fuel development. However, as seen in the techno-economic perspective, the national infrastructure of the transmission grid is incomplete and experiencing bottlenecks which is a challenge for renewable energy development. The transmission grid is currently monopolized by EVN, a SOE, and Vietnam is undergoing a reform and restructuring of the SOEs in the power sector, to attract private sector participation. Vietnam highlights the need for socialization of energy development. The restructuring of the energy sector with SOEs and equitization paints a picture of this co-evolving of systems. The incumbent energy regime actors under the socio-technical perspective are facing challenges due to the

techno-economic factors of increasing energy demands with domestic supply bounds and the incomplete transmission grid. This is resulting in the state under the political perspective restructuring the sector in order to ensure energy security by diversifying the energy mix with increased focus on renewable energy development.

8. Discussion

This thesis set out to present an overview of what an energy transition looks like from the Vietnamese perspective. A key question asked repeatedly during this research project has been whether Vietnam is within the process of an energy transition as emissions are poised to increase in a growing economy dependent on fossil fuels. According to the theoretical framework, which incorporates the path dependence of fossil fuel energy systems, the energy system has to un-lock for an alternative to enter. Vietnam has been able to start to un-lock its energy system as they have had recent success with solar and wind (EREA & DEA, 2022; Do, et al., 2021). This un-locking of the energy system spurred Vietnam's ongoing energy transition. Policy changes with state goals such as net-zero emissions by 2050 and the increased emphasis on renewable energy in energy policy and planning pushes forth this transition.

The ongoing energy transition in Vietnam is, to some degree, breaking the path dependence of the traditional and historical development by fossil fuels. As seen in the theoretical framework, energy transition in highly developed economies is different than that of emerging economies, with some researchers arguing that it might be easier in developing economies as the transition is not from a fully developed system and an overturn of that system (Wieczorek, 2018). Energy infrastructure can be locked into carbon. For Vietnam the energy system with its infrastructure will need to continue to develop anyways, either for fossil fuel or renewable energy, as the country is still in the development phase with aims of continued strong economic growth. An energy transition in a developing context is occurring alongside energy sector development. Energy transition in Vietnam occurs as they are trying to avoid the middle-income trap and secure energy for continued development with modernization and industrialization, while at the same time follow global integration trends of green growth, sustainable development, and ultimately their net-zero emissions target by 2050. Going forward this discussion will focus on the global context of the energy transition in Vietnam.

8.1 Policy diffusion and the global climate change agenda

Vietnam is participating in the global climate change agenda with their net-zero emissions target. Previous research on Vietnam's motivations for low-carbon development found national energy security to be a strong motivational factor for Vietnam to align with the global integration trend

of low-carbon development (Zimmer, Jakob, & Steckel, 2015; Ialnazov & Keeley, 2020). Apart from the need to align national and international agendas to overcome the possible new trade barriers of the green shift, as highlighted in the National Climate Change Strategy from 2011, Vietnam is also found to have several other motivations for aligning to the global low-carbon development agenda. Zimmer et al (2015) found that the country's climate change vulnerability placed low-carbon development on the agenda. However, the shift in policy focus from mainly adaptation to mitigation was driven mostly by the "so-called co-benefits" (p. 19). The co-benefits of climate policy included, "restructuring of the economy, addressing energy security concerns and accessing international finance to counteract the phase-out of conventional development assistance" (p. 19). Increasing air pollution did not seem to play a significant role in the change in climate policy (Zimmer, Jakob, & Steckel, 2015). Ialnazov and Keeley (2020) also found concerns about a slowdown in economic growth due to the middle-income trap and therefore Vietnam welcomes new technologies that could increase productivity, such as renewable energy technology (Ialnazov & Keeley, 2020).

As seen in table 6 under the heading institutions and capacities Vietnam highlight the need for international support in terms on finance, technology and capacity building. As well as the need to harmonize policies on the international and national level, as global financial flows shift to low-carbon development. Vietnam's conditional NDC target also signals the need for international support due to Vietnam's limited capacity. Most developing countries make their contributions under the Paris Agreement conditional on international support, such as finance, technology transfer and or capacity building (Pauw, Castro, Pickering, & Bhasin, 2020). Arguably, in the context of the global climate change agenda and the Paris Agreement, the thought behind aligning global financial flows with low-carbon development and mitigation pathways was to incentivize this type of policy diffusion. The next section discusses the use of coal as Vietnam also joined the Global Coal to Clean Power Transition Statement to phase out unabated coal power during COP26. Do and Burke (2023) found that the drivers of Vietnam's decision to phase out coal was to attract "international support for green growth" (p. 9) as financing for coal-fired power projects are limited.

8.2 Coal dependence and the global coal phase-out

The global landscape factor of the global coal phase out is affecting coal dependent energy systems. Vietnam's continued dependence on coal is debated in Vietnam as finance of coal developments are harder to come by these days as coal is 'out' and renewables are 'in' (Hai, 2021). This is signaled by the fact that more than 70 countries including the biggest polluters today; China, United States and the EU accounting for over half of global emissions have communicated their net-zero plans. This is also including major fossil fuel exporters (United Nations , 2023). Furthermore, 41 countries have signed the Powering Past Coal Allegiance agreeing to phase out coal in the EU entirely by 2030 and the world by 2050 (La Camera, 2021).

Most of the investment for coal-fired power plants in Vietnam comes from three strong regional players, China, South Korea, and Japan (Hai, 2021). China's coal power investments have been part of their Belt and Road Initiative, many of them in developing countries. For the first time in several years China made no new coal investment during the first half of 2021 (Brant, 2021). South Korea invested in a coal-fired power plant in Vietnam in October of 2020 that resulted in heavy backlash from the international community as it went against its new Green Growth Policy. The South Korean President announced at the Leaders Summit on Climate in April 2021 that the country would stop investing in coal power development projects abroad (Hai, 2021). China's President Xi Jinping announced in his address at the United Nations General Assembly annual summit that China will not build any new coal power projects abroad in their efforts to support developing economies to develop low-carbon energy (Brant, 2021). Many large financial institutions in Asia previously involved in coal power development in Vietnam are also shifting their investment portfolio away from coal to renewable energy and LNG. Banks and lenders such as OCBC (Singapore) withdrew from coal funding in 2019 and CIMB (Malaysia) has announced a coal exit from December 2021. The Japanese trading house Mitsubishi Corporation withdrew from a scheduled coal power project in Vietnam 2021 due to international pressures (Huong, 2021). A coal-phase out like that of South Korea, China, and financial institutions plays a significant role for Vietnam's energy development strategy as Vietnam is largely reliant on foreign investment. This makes coal a volatile fuel source as the future of coal is uncertain.

Vietnam's focus on coal has been criticized on the national level by local NGOs such as Vietnam Green Innovation and Development Center (Green ID), Vietnam Sustainable Energy Alliance (VSEA), Oxfam Vietnam among others (Sen, 2020; Hai, 2021). VSEA recommended in a letter responding to the PDP 8 draft, during the public feedback round, to not continue with the development of new coal-fired power plants for the next ten years, arguing that the focus should instead be on the development of renewable energy (VSEA, 2021). During the final stretch of this research several reports came out that Vietnam had sent out a new revised draft PDP 8 (October 2021) for approval that reduced renewable energy targets of 8 GW by 2030 and increased the proportion of coal with about 3000 MW compared to the previous draft (Baker Mckenzie, 2021; Tachev, 2021; Watson Farley & Williams, 2021). Despite efforts to locate the latest draft version of PDP 8 this was unsuccessful and therefore not used in this research. However, it is worth mentioning as the Draft version of PDP 8 used in this thesis is only tentative.

Previous research on the political economy of coal use and actor objections in Vietnam has found interesting factors relevant for the country's energy transition pathway. Dorband et al (2020) found that the coal developments for power generation in Vietnam is largely motivated by political factors rather than economic factors. They found that factors such as affordability of electricity prices, in line with the communist heritage of providing affordable basic needs, and security of supply for continued economic development as strategic pillars of the CPV's legitimacy. They also found that the focus on coal for electricity development is "primarily driven by the incumbent networks between decision-makers in the Communist Party, the Ministry of Industry and Trade "Energy Ministry", responsible for regulating the energy sector, and the state-owned enterprises (SOEs)" (Dorband, Jakob, & Steckel, 2020, p. 9). This can be linked to the concept of special interests in the political perspective as well as the prevailing energy regime of the socio-technical perspective. The objectives and aspirations of the complex web of actors in the energy sector is embedded in the overall political and socio-economic context. Going even further, Dorband et al (2020) found that the vested interests and personal ties within the incumbent network of the energy sector with fossil fuel SOEs to be a barrier for renewable energy development. Highlighting the notion of the revolving door between MOIT, responsible for regulating the energy sector, and the SOEs. EVN has strong influence on MOIT and is mentioned as being "the most powerful player and 'barrier of the country' to energy sector

reform” (Dorband, Jakob, & Steckel, 2020, p. 7). Ialnazov and Keeley (2020) also finds that the power of the incumbents could be a barrier to energy transition in developing countries due to the strong lobbying power. EVN is the main actor in the national transmission grid and Vietnam state the lacking capacity of the transmission grid to accompany the rise in renewable energy development as a challenge in NDC implementation and mitigation (Socialist Republic of Viet Nam, 2022). This is also emphasized in the Politburo’s Resolution 55 with the wording “to break down the monopoly“ (p. 9) and signals further focus and emphasis on energy sector reform with privatization of the power sector and transmission system. The next chapter concludes this thesis with a short summary of the main takeaways of this research and gives recommendations for future research.

9. Conclusion

The main take aways of this research is that energy transition in Vietnam signals increased energy security. By increasing domestic supply through diversification of the energy mix with renewable energy development Vietnam can reduce its increasing dependance on imported fossil fuel and particularly coal. Vietnam's focus on improving the national transmission grid to accompany this transition is also a positive factor here as transmission bottlenecks threatens energy security as well as increased renewable energy development. Additionally, considering the global state of coal with a global phase down or phase out which is making future coal developments uncertain.

The global climate change agenda, with the Paris Agreement, is pressuring fossil fuel energy systems globally to transition to renewable energy in order to curb climate change. Vietnam is participating in the global climate change agenda with their net-zero emissions target but in order to curb climate change this must be followed by action. Vietnam is balancing a growing economy and increasing demands for energy with the need for carbon mitigation. Energy transition in Vietnam is not an easy task considering this balancing act of ensuring national energy security while at the same time needing to mitigate climate change in fossil fuel dependent energy system. Energy transition in Vietnam is both national and global. The process of transitioning from fossil fuels to low-carbon energy is not occurring in a vacuum, separated from global influences. It is global due to the level of global integration of markets, and in the sense as Vietnam highlight in their NDC, that Vietnam is not able to do this on their own and need international support to aid in the transition to net-zero emissions by 2050. Vietnam seeks international support in financing, technology transfer and capacity building.

Energy security is crucial for the socio-economic development goals of Vietnam as they strive for modernization and industrialization. Developing countries with rapidly growing economies, particularly in Asia, which plays an important role in the future of coal, are increasingly gaining an important role in shaping global energy outlooks. This makes the region an important player in the global context of an energy transition. Moving away from fossil fuels in the region is of interest, not only the to the region itself, but also the global community in order to meet the goals of the Paris Agreement.

9.1 Recommendations

This thesis set out to give overview of important factors influencing the energy transition pathway in Vietnam and uses the theoretical framework to provide an overview perspective. Since Vietnam's power sector currently dependent on fossil fuels have had recent success with solar and wind it would be interesting to use the three-perspectives framework on the power sector specifically to get a more in-dept understanding on that sector.

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