Shaping Solar Horizons: Exploring Policy and Expert Envisioning of Socio-Technical Imaginaries in Ouarzazate's Solar Development

Carmen Haasdijk I S4122380

MSc Environmental and Infrastructure Planning

August 2023

university of groningen

Colophon

Title: Shaping Solar Horizons: Exploring Policy and Expert Envisioning of Socio-Technical Imaginaries in Ouarzazate's Solar Development

Master's Thesis: MSc. Environmental and Infrastructure Planning

Theme: Environmental Justice

Author: C. (Carmen) Haasdijk

Student Number: S4122380

Contact: c.haasdijk@student.rug.nl

University: University of Groningen / Rijksuniversiteit Groningen

Faculty: Spatial Sciences
Landleven 1
9747 AD Groningen

Supervisor: dr. E. (Ethemcan) Turhan

Date: 17 August 2023

Status: Final version

Word count: 23. 571 (incl. tables)

Acknowledgement

August 2022 the month I visited the world heritage in Ouarzazate. I watched the beautiful scenery of the old Kasbah Taourirt in the sun's glow. En route to the city, fenced and guarded posts popped up in the arid areas. The most giant solar power plant in the world, they told me. Not knowing what was behind the fences, my curiosity about the Noor Ouarzazate project grew. However, I did not know yet that a year after visiting the city of Ourzazate I would finalize my thesis a year later on the Noor Project Ouarzazate. So here I present my master's thesis that is written to finalize my Master's Study in Environmental and Infrastructure Planning at the University of Groningen.

The process of writing this thesis was sometimes challenging. First, I would like to thank my supervisor Ethemcan Turhan for his guidance and the nice way of giving feedback. Furthermore, thanks go to my loved ones for supporting me throughout the process of writing and finalizing this thesis.

Carmen Haasdijk

August 2023, Tampere.

"(...) والله لا يظلم (أي شخص) في العالمين". [القرآن 3: 108]

Abstract

Providing energy in its most suited form is the greatest challenge facing the globe in the twenty-first century. The Kingdom of Morocco's major challenges regarding the power grid include the growing energy demand and the country’s dependence on energy imports. To become less dependent on the import of energy, the Kingdom of Morocco has been seeking to scale up its renewable energy infrastructure over the past decade as the country enjoys potential solar irradiation. A pathway of Morocco's strategy is the development of five CSP projects, the largest of which is located in the city of Ouarzazate. Taking the case of Ouarzazate in the south-east of Morocco and located in a semi-desert and rigorous pre-Saharan environment, this thesis aims to explore how different experts and policies envision socio-technical imaginaries (STIs) on solar development in Ouarzazate and then see if there are tensions between expert and policy STIs and the implemented outcome of these visions. Previous studies have not frequently examined how policy initiatives and their results align with the intended STIs. Therefore, the focus of this study will be on the expert visions and policies that propose their STIs for Morocco's energy development. By drawing on data from Moroccan policy documents, news articles, reports, and opinion pieces, this research develops an understanding of STIs from experts and policy regarding solar development and the outcomes of the imposition. The research has found that policy strongly emphasises the advantages for the environment, energy security, social progress, and economy. However, other expert viewpoints also emphasised challenges like social inequities, the need for improved information exchange and community consultation, and the need to take the local context into consideration when implementing projects that affect conflictual STIs of solar development in Ouarzazate. Implying that STIs have implications for the acceptance of the implemented outcomes, it is important for policymakers and energy experts to gain more understanding of the social and justice implications to better engage with the various ways solar energy development is envisioned.

Keywords: Socio-technical Imaginaries, Solar Energy Development, Policy Implications, Expert Vision, Social Justice Implications

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List of Acronyms

ADEREE: Moroccan Agency for Development of Renewable Energy and Energy Efficiency

CSP: Concentrated Solar Power

GHG: Greenhouse Gases

IRESEN: Research Institute for Solar Energy and New Energies

LAP: Land Acquisition Plan

MASEN: Moroccan Agency for Sustainable Energy

MEMEE: Moroccan Energy Observatory

MENA: Middle East and North Africa

MSP: Moroccan Solar Plan

MW: Megawatt

NDC: Nationally Determined Contributions

NES: National Energy Strategy

NGO: Non- Governmental Organisation

NIMBY: Not In My Backyard

ONEE: National Office of Electricity and Drinking Water

PV: Solar Photovoltaics

RE: Renewable Energy

STI's: Socio-Technical Imaginaries

1. Introduction: Exploring Policy and Expert Socio-Technical Imaginaries in Ouarzazate's Solar Development

1.1 Research Background

Morocco announced its solar plan in 2009 as part of its goal to produce 42% of its energy from renewable sources by 2020, with 14% coming from solar (Oxford Business Group, 2016). Over the past decade, the Kingdom of Morocco has been seeking to scale up its renewable energy (RE) infrastructure to be less dependent on importing energy and to cope with the increasing demand for energy in Morocco (Azeroual et al., 2018). In 2015, Morocco had to import over 96% of its energy supply from outside (IEA, 2014). The development of RE sources and infrastructure would help reduce dependence to 82% by 2030 (Azeroual et al., 2018).

The Middle East and North African region (MENA) have proven to be good places to instal solar power fields and generate RE (Schinke and Schetter, 2015). The geographical conditions of Morocco are auspicious in terms of its large potential for wind, solar, and hydropower energy generation (Kousksou et al., 2014). In line with the orientation to the development of renewable energies, the government of Morocco expanded solar energy development through the construction of a visionary project known as the Noor project (Azeroual et al., 2018). The Noor project has been realised and is being further expanded in Ouarzazate, located in the south of Morocco. Ouarzazate is a city in the pre-Saharan region on the southeast side of the Atlas Mountain that runs across Morocco from north to south (Ryser, 2019; Aslan, 2014). The ambitious plan to significantly increase the nation's solar power in a matter of years includes the Ouarzazate Solar Power Station Project (Noor project) (Cantoni and Rignall, 2019). The Noor Project Ouarzazate is helping to meet national commitments defined in the Moroccan Solar Plan and the Moroccan National Energy Strategy (African Development Bank, 2012). One of the largest RE projects in the world, the Noor Ouarzazate solar power plant, was officially inaugurated in 2016 on a 1.4 million square metre plot (Al-Marini, 2022). The Noor project in Ouarzazate makes use of concentrated solar cell technology. Concentrated solar power (CSP) uses a method that concentrates sun rays in a small area to create intense temperatures and thermal energy, which are then transformed into electricity (Zhou et al., 2019).

The case study of Ouarzazate can be placed in a global trend of RE as a sustainable alternative to traditional fossil fuels. The transition to RE is seen as a crucial step in decarbonising the global economy and mitigating climate change. Most nations have developed national development strategies that align with the Sustainable Development

Goals, including switching to RE sources (Abdelrazik et al., 2022). Also, the national governments in the Middle East and North Africa set ambitious objectives to generate a significant portion of the energy mix from RE, such as solar energy (Hanger et al., 2016).
Governing the energy transition in the Global South can be described on the one hand as autocratic mega-projects with considerable fallout for local communities and on the other hand as promising projects to foster a better, sustainable, and more inclusive future (Haddad et al., 2022). The description by Haddad et al. (2022) implies that besides the promising projects and the favourable location in the MENA region for generating RE, there is also a shadow side to the story. Many forms of (renewable) energy development have spatial, economic, social, and ecological implications (Cederlöf, 2021). It is questioned by environmental and human rights organisations, researchers, and research activists whether the large renewable energy projects will have an undeniable positive impact on the local community (Schinke and Schetter, 2015). Energy technologies can impact people's health and livelihoods and present new or different risks for those already most vulnerable to the effects of climate change (Levenda et al., 2021; Mulvaney, 2019). It can lead to an unequal distribution of environmental change's consequences and allocation of the costs and benefits associated with resource extraction (Cederlöf, 2021). Consequently, RE initiatives may not be favourable regarding the environment and social impact caused by the unfair extraction of the benefits of energy generation (Feyertag, 2021; Akizu et al., 2017).

Energy transitions are more than just a process of replacing one type of electricity generation with another technology, they are complex issues of social change that unfold on all levels of society and are subject to various interests and objectives (Döring et al., 2018). Policy is crucial because it can structure societal opposition rather than support. All policies and actions must be coordinated to achieve the same transformation for society to realise its envisioned goals for energy transitions (Döring et al., 2018). RE infrastructure needs an enormous policy commitment (Lee and Byrne, 2019), as Goodstein and Lovins (2019) argue that local, regional, and national policies play a role in speeding up or slowing down energy transitions.

Besides national goals and policies for governing the RE transition, socio-technical imaginaries (STIs) can influence new policy strategies that increase public support and address the essential difficulty of achieving a just and equitable result when moving towards carbon neutrality (Echevarria et al., 2022). STIs are collective perspectives on desirable futures (Jasanoff and Kim, 2009). Policymakers and experts reflect these favoured STIs and play an important role in creating STIs around solar energy (Vesnic-Alujevic et al., 2016; Levenda et al., 2021). According to Bridge et al. (2018), big narratives that imply some sort of universal benefit and pressing necessity are mostly used to justify the promotion and

development of energy infrastructure. Policy-makers and other experts must consider more than only the technical and financial challenges while creating and implementing RE solutions (Levenda et al., 2021). The STIs consider how social and political factors influence energy transitions (Carvalho et al., 2022). STIs contribute to the perception of an energy transition characterised by environmentally just and sustainable justifications (Levenda et al., 2021; Stock, 2022). Different actors, social groups, and their STIs are significant in revealing the specific perspectives and RE pathways that the actors are leaning towards (Carvalho et al., 2022).

As stated earlier, RE resources offer a promising alternative to moving away from carboniferous energy resources (Mulvaney, 2013). Local, regional, and national policies can accelerate or slow down energy transitions (Goodstein and Lovins, 2019). According to Outka (2012), RE occupies a specific position on the policy spectrum because it links local communities that host renewable projects to national and international plans to restrain climate change's effects. In light of the negative effects on the environment and society brought on by unfair energy extraction and distribution, RE efforts may lead to unfavourable outcomes (Feyertag, 2021; Akizu et al., 2017). As previously described, due to the implications of solar energy development, actors have different perspectives regarding solar energy development. These STIs can be both positive and negative regarding solar energy development. Multiple reasons for opposing perspectives on solar energy development are identified as trust, distributional justice, and procedural justice (Outka, 2012; Wüstenhagen et al., 2007) and will be further discussed in the theoretical framework.

1.2 Research Motivation and Aim of the Study

Since siting large-scale solar projects is often controversial (Outka, 2012), it is important to explore the STIs of policy, decision-makers, and other experts as they can facilitate low-carbon energy transitions but at the risk of generating negative social, environmental, and political impacts (Okpanachi et al., 2022). Existing literature focuses on the dynamics of RE transitions, mainly in the Global North (Okpanachi et al., 2022). This research will focus on the research gap in understanding the dynamics of RE transitions in the Global South. Furthermore, studies on just energy transitions are broadly concerned with power dynamics, the national security consideration of energy with less space for inclusive participation, and how RE becomes supported by a variety of actors (Haddad et al., 2022; Ryser, 2019; Cantoni and Rignall, 2019). Besides, the alignment of policy interventions and their outcomes and the desired STIs have not been explored often in previous studies. Therefore, this research will focus on policy and experts shaping and imposing STIs regarding energy development in Morocco. The result of the study could be valuable for giving insight into how

policy and expert STIs impact how RE infrastructure development is shaped and the impact on the social, economic, and environmental aspects of solar development in Morocco and in similar countries in the MENA region.

This thesis examines how various experts and policies manifest STIs for solar growth in Ouarzazate and examines whether there are conflicts or alignments between these STIs and real-world developments. The aim of the thesis leads to the following primary research question:

How do the socio-technical imaginaries on solar development differ between those provided in the national energy policy and the visions of the energy experts in Morocco?

To answer the main research question, the following secondary questions are proposed:

1. How does policy frame the socio-technical imaginaries of solar energy development in Morocco?
2. What are the socio-technical imaginaries held by experts that informed the development of the Noor Ouarzazate solar energy project?

1.3 Thesis Outline

In what follows, the thesis first presents a theoretical framework that is built up of three building blocks. First, it will discuss the understanding of rapid transitions towards RE and the upswing and outlook of solar energy. Then the focus is on STIs. Second, the focus on STIs will provide a framework for analysing policy and expert STIs by focusing on the dimensions of STIs. Third, section 2.3 will investigate the issues accompanying RE developments and elaborate on the idea that solar energy infrastructure can also be opposed. Chapter 3 presents the methodology, including the data collection approaches to answer the research questions. This study followed a qualitative research method, including interpretive policy and document analysis. Chapter 4 will focus on the case study of Ouarzazate. It will first outline the history, current situation, and outlook for solar energy in Morocco. Chapter 4 also includes an analysis of national policy regarding RE and particularly solar energy. The document analysis will give insight into the STIs that experts hold. The presentation of the findings in Chapter 4 will help the reader understand the context of Morocco, its energy transition, and the STIs accompanying it. It also gives insight into the STIs envisioned by experts and policy. Chapter 5 will discuss the research findings while also considering the STI theory, transition theory, and Morocco's background. Chapter 6 will showcase the conclusions and the implications for practice. This is followed by the last chapter, which outlines the limitations and strengths of the research, opening room for

further studies regarding STIs and RE transition and will include d personal reflection of the research process.

2. Theoretical Framework: Contextualising the Socio-Technical Shift towards Clean Energy

Globally, climate change concerns have focused on RE. A transition to green energy is intended to shift from high-carbon fossil fuels to low-carbon clean energy, such as solar, wind, hydro, bioenergy, and geothermal energy sources (Tian et al., 2022). This research focuses on three bodies of literature. First, it uses transition theory to understand the complex nature of transitions. It highlights the importance of actors, policy, institutions, power dynamics, and changes in mindsets and belief systems in supporting or opposing the speed and direction of transition, which is especially applicable to low-carbon transitions. STIs are essential in determining the desired future and how transitions will proceed. Therefore the second section of this chapter dives into STIs and their role in shaping low-carbon transitions to uncover how different actors and their diverse STIs mobilise RE development. Besides, this study uses socio-technical imaginary literature to analyse Morocco's Noor Ouarzazate concentrated solar power station. The last part of this chapter will focus on land acquisition and opposition to RE transitions and understanding the factors that can help influence the social acceptance of RE projects. Lastly, Chapter 2 concludes with the conceptual model.

With an emphasis on the involvement of experts, policy, institutions, and power dynamics, transition theory offers a framework for understanding the total process of switching from one energy system to another. It acknowledges that transitions have many facets and calls for the participation of numerous stakeholders in order to influence the transition's speed and course. On the other hand, STIs concentrate on the perceptions, desires, and narratives of various actors have about the idealised energy future. By influencing the actions, behaviours, and decisions of people and organisations participating in the transition, these imaginaries impact the mobilisation of RE development. STIs reveal the underlying socio-cultural variables that can help or hinder the transformation process.

2.1 Understanding the Complexity of Energy Transitions

Research into transitions has gained more attention in the last decade. A transition, as defined by Rotmans et al. (2000), is the result of the co-evolution of cultural, institutional, economic, ecological, and technological processes and developments at various scale levels leading to a structural change in how a society system functions and that takes decades to manifest. Meadowcroft (2009) indicates that the process of structural change takes place

over the long term, i.e. 25 to 50 years. In addition, Gruber et al. (2017) and Smil (2016) contend that the development of complex systems and the advancement of technologies required for the transition to switch to RE sources takes a significant amount of time. The concept of transition can also be viewed in another way. According to Sovacool and Geels (2016), a transition is a staged shift from one system to another, which is consistent with Rotmans et al. (2000) assertion. A co-evolution process necessitates modifications to the way a socio-technical system operates. A socio-technical system not only includes the technical and infrastructure components but also policy, market, ecology, institutions, cultural meanings, and processes of development on different scales (Rodríguez-Manotas et al., 2018; Rotmans et al., 2000; Sovacool and Geels, 2016). The co-evolution process of the socio-technical system includes modifications to the observable components of these socio-technical systems, actors, and regimes, such as (in)formal rules, mindsets, belief systems, and social practices, which is in line with Loorbach (2010). To investigate the rapid energy transition, this research takes into account not only the technical components but also the social and policy components to show the overall dynamics of the socio-technical transition (Rodríguez-Manotas et al., 2018; Rotmans et al., 2000; Sovacool and Geels, 2016).

Following the 1973 and 1979 oil shocks, enthusiasm for alternative energy sources and environmental consciousness arose. The initial investment in RE technology materialised slowly and was limited to a handful of frontrunner countries (Aklin and Urpelainen, 2018). Increasingly, a shift from carbon-emitting fossil fuels to renewables is the backbone of any energy transition to achieve net zero (IEA, 2021). This is in line with Aklin and Urpelainen (2018), who argue that a transition implies that an energy system, although supported by fossil fuels and shaped by the carbon lock-in, sees a rapid increase in the use of renewable electricity. For a transition to occur, it is crucial to remember the history, cultural, and institutional practices and the selection pressure (Kirshner et al., 2019). Changes in the energy sector became more promising, which led to a widespread adoption of renewables and related technologies (IRENA, 2020). Figure 1 demonstrates the acceleration phase of RE generation.

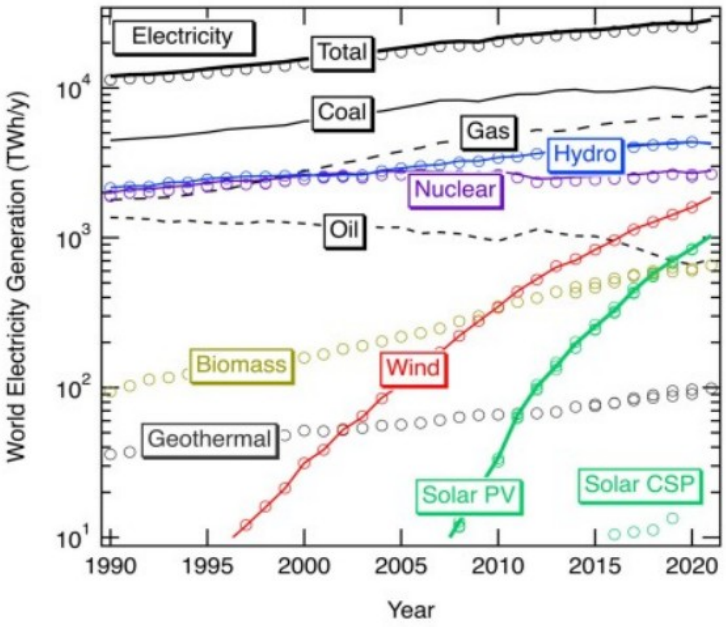

Figure 1: Global Annual Electricity Generation from 1990 to 2020 (Source: Haegel and Kurtz, 2022)

Nowadays, the global clean energy transition is still accelerating and is mainly driven by policy, technology and economics (IEA, 2023). Predictions note that between 2020 and 2026, the RE capacity will increase by over 60% worldwide (IEA, 2021). The quick global adoption of solar photovoltaic (PV) technology from the early 2000s and CSP from 2015 is particularly striking and showcased in Figure 1 (IEA, 2023). This notable increase in solar PV and CSP needs some deeper investigation. PV technology is a widely used, dependent, and adaptable method of generating electricity. Solar PV is entering a phase of regime-like formation in terms of knowledge, capabilities, finance, and skills, which contrasts with the long-standing regimes of centralised electricity generation, transmission, and distribution, particularly those that rely on coal, hydroelectricity, nuclear energy, or gas and will take decades to reconfigure (Kirshner et al., 2019).

Besides a significant increase in solar PV, CSP is one of the most viable and promising RE technologies that can be scaled up for a rapid transition (Powell et al., 2017). The potential to create heat from the sun rather than burning fossil fuels makes CSP power plants novel (Rashid et al., 2019). This would reduce greenhouse gas emissions (GHG), reduce reliance on fossil fuels, and produce cleaner electricity (Rashid et al., 2019). CSP differs from PV technologies because the CSP technology uses collected heat that produces steam and is then converted into electricity by a turbogenerator. In contrast, PV technologies directly convert solar energy into electricity (Burgeap-Phenixa, 2011).

CSP technology uses mirrors, lenses, and other optical devices to focus the sun's insolation onto a small receiver area to gather solar energy. An absorber transfers heat from focused solar radiation to a heat transfer fluid, which powers a thermodynamic system based on a thermodynamic cycle to produce electricity (Werner and Kalb, 2010; Rashid et al., 2020; Kurkute and Priyam, 2022). The receiving area can have different classifications, such as a central solar tower receiver, solar dish concentrator, and focal line of the paraboloid mirrors (see Figure 2). Figure 2 shows the different types of CSP technologies, from left to right: a focal line of paraboloid mirrors, a central solar tower receiver, and a solar dish concentrator. Rashid et al. (2020) explain that a CSP plant is divided into three central units. The first unit is solar energy collection that, consists of the concentrator, the receiver, and the piping system, The second unit is thermal energy storage, and the last unit is the thermal power generation unit, which includes the generator or the heat engines that is creating heat which creates steam which drives a steam turbine which generates electricity (see Figure 3).

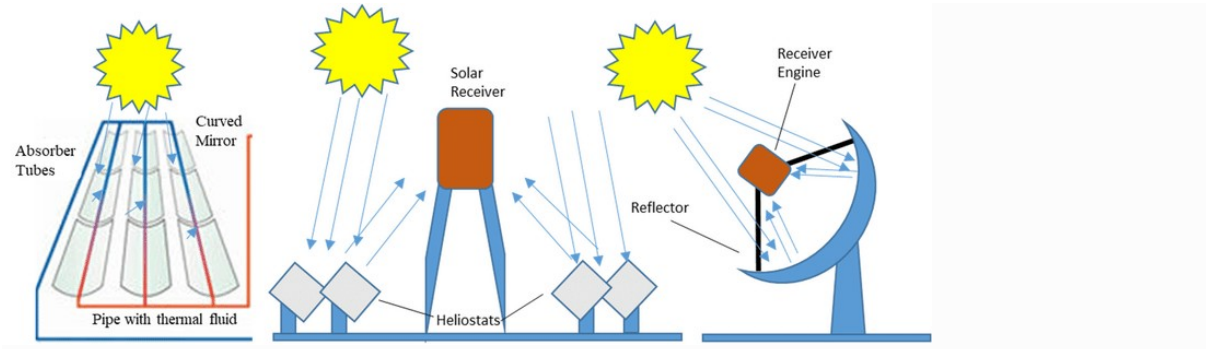

Figure 2: Types of Concentrated Solar Power Technology (Source: Albarbar and Arar, 2019).

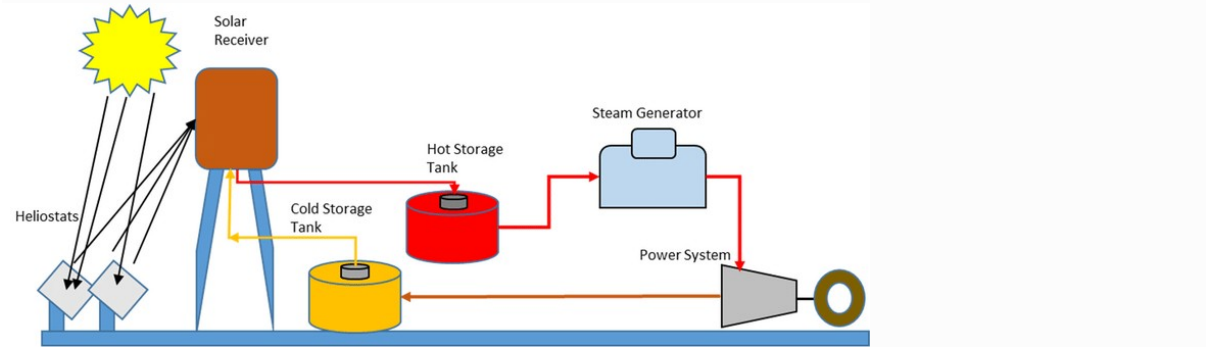

Figure 3: The Operation of Concentrated Solar Power Technology (Source: Albarbar and Arar, 2019).

Desert regions are perfect places for CSP because these are places with a high amount of direct solar radiation (Werner and Kalb, 2010). Currently, solar towers are a commercial-

scale technology with multiple projects of over 100 Megawatt (MW) capacity being undertaken, which also appear profitable in the 50–100 MW range (Kurkute and Priyam, 2022). Furthermore, acceleration was possible because the cost of solar PV technology has decreased significantly since 2010. In many cases, solar PV electricity is already cost-competitive with fossil fuel-based generation (Haegel and Kurtz, 2022). Figure 4. illustrates that the costs of various RE technologies are expected to decrease in the following decade. Solar PV and wind are increasingly the cheapest sources of electricity in many markets, and most renewable power sources will be fully cost-competitive within the next decade. Similarly, CSP will face reduced costs related to the technology (IRENA, 2019; IRENA, 2020).

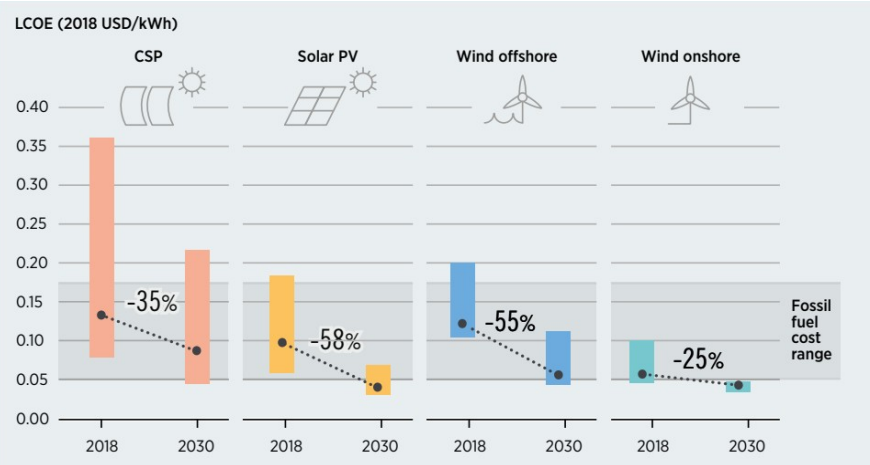

Figure 4: Expected Cost Reduction Solar and Wind Power until 2030 (Source: IRENA, 2020)

The emergence and potential of the energy transition with solar power as a significant player can be described as promising and fast. The next step is to investigate why energy transitions are faster compared to other transitions.

As shown in Figure 1 and according to the IEA (2020;2021;2023) and IRENA (2019;2020) reports, solar energy has experienced significant growth. Sovacool and Geels (2016) reported that low-carbon transitions are more rapid than earlier historical transitions because policies are influenced by public urgency and political will, which could lead to changes in various areas. Indicating the factors that help develop an energy transition rapidly will help identify how actors can serve an environmentally just transition. Faster development of the low-carbon transition is made possible by using transition politics, power and agency, and the historical and spatial context (Goodstein and Lovins, 2019). Besides, there will remain a critical role for smart policy to accelerate and manage a transition that must happen quickly to meet and exceed the Paris goals (Goodstein and Lovins, 2019), institutional innovation

and top-down approval as elements that contribute to a quick transformation in the energy sector.

Politics and power play a significant role in realising a clean energy transition. The research of Rodríguez-Mantos et al. (2018) argues that within these currents of power and politics, institutional innovation could significantly support the transition's speed.

New regulations created to promote solar energy development are referred to as institutional innovation. The emphasis of the new solar energy deployment incentives and regulations emphasise a quick, extensive solar deployment with little input from stakeholders (Mulvaney, 2013). In relation to the argument of Mulvaney (2013) regarding little input from stakeholders, Luederitz et al. (2017) point out that discussions on energy transitions frequently occur among people with comparable entrance points rather than between people with different understandings.

According to Goodstein and Lovins (2019), local, regional, and national policies can slow down or speed up the energy transition toward solar dominance. Promoting a low-carbon transition has a role for smart policy in accelerating and encompassing a wider focus of various domains (economic, political, social, and geopolitical shifts). Power also significantly affects how quickly policies and institutional changes are implemented and to what extent they are included. Decision-making in socio-technical transitions is characterised by Lawhon and Murphy (2012) as power-ridden. This raises questions regarding public accountability.

According to Ockwell et al. (2018), a top-down endorsement causes quick transformations. Also, in the Global South, a centralised approach to implementing large-scale renewable projects is the preferred way to operate (Sim and Mills, 2021). Leftwich (1995), argues that a strong state is needed for the occurrence of modernisation. Moreover, elites committed to growth are required, and they must be a part of powerful public institutions as their involvement can help to implement rapid, extensive solar deployment with little input from stakeholders who have a different opinion (Mulvaney, 2013; Luederitz et al., 2017). The Rajasthan mega solar project in India shows the strong role of the state centred on energy practices and the effect of energy development on marginalised inhabitants. Therefore, this Indian case illustrates how politics and power can affect the shift to RE. Small or medium-sized actors may be subject to a lack of participation, socio-material incumbency, and imposed competitive advantage (Sareen and Shokrgozar, 2022). Sareen and Kale (2018) note that local people have marginal involvement in the site selection process and access to generated energy and financial benefits. This hinders possible improvements in environmental justice results. Additionally, firms that depend on fossil fuels and those that distribute electricity use their lobbying influence to oppose sectoral changes resulting in

these just and long-lasting outcomes. Rural areas are where the central state's sustained influence is most apparent (Haddad et al., 2022). In order to support neo-colonial forms of production, the mega solar project in Rajasthan, India, is also grabbing commons in Rajasthan by discursively reclassifying them as "wasteland," a phrase that dates back to the times of colonisation (Baka, 2017; Stock, 2021).

In the context of the Rajasthan big solar project, this section emphasises the impact of politics, power dynamics, and social processes on the shift to RE. These elements highlight how critical it is to comprehend how transition processes' social and material sides of transition processes interact. The core of transition theory is the social and material entanglements. When looking at socio-technical and sustainability transitions, it considers how social processes co-evolve with technical, infrastructural, and ecological systems. Therefore, in addition to the elements mentioned above, the following section will focus on the politics of energy infrastructure and STIs that shape the visions of a desired future and affect the direction and speed of energy transitions.

2.2 Politics of Energy Infrastructure and Socio-technical Imaginaries

This section reflects on understanding the complex intersection between energy infrastructure and political work infrastructure performs and focuses on STIs to understand the politics of energy infrastructure. The intersection of energy infrastructure and politics carries profound implications, shaping the trajectory of energy transitions. We acquire a comprehensive grasp of how energy infrastructure politics extends beyond its physical components by exploring this interaction between envisioned futures, societal ideals, and the realities of energy systems. This investigation shed light on how the visions embodied in energy infrastructure interact with the larger web of governmental and social structures.

As infrastructure forms the constructed networks that facilitate the movement of people, ideas, or both across distances (Larkin, 2013), Collier (2011) further emphasises that it encompasses administrative methods, material systems but also political rationality. His focus is not on the infrastructure itself but on what it reveals about governmental practices. This demonstrates that infrastructure has distinct forms from their solely technical operation (Larkin, 2013). The politics of energy infrastructure implies that infrastructure and all other energy facilities create political effects (Bridge et al., 2018). The relevance of energy infrastructure is now widely acknowledged in the social science literature as surpassing its technological capability for transmitting, transforming, or storing energy (Shove and Walker, 2007; Geels, 2011). According to Bridge et al. (2018), energy infrastructures can sustain political and economic power, which is interpreted in various ways. The first method is the politics and geopolitics of energy infrastructures, emphasising using energy as a resource

competition and a means for nations to achieve power and influence (Bridge et al., 2018; Fischhendler et al., 2015). The impact of energy infrastructure on unequal socioeconomic outcomes is the subject of the second interpretation (Bridge et al., 2018). The third body of work, sociotechnical imaginaries and critical geopolitics, focuses on political ambiguity and the focus on how space is constructed socially by energy infrastructure (Bridge et al., 2018). Recognising the societal values and policy decisions engraved with the design and operation that become incorporated into infrastructural systems is the fourth method to look at energy infrastructures and political and economic power (Bridge et al., 2018; Goldthau and Sitter, 2015). The fifth strategy incorporates a mobilising force and an important political intermediary in and of itself, influencing individual and communal rights (Bridge et al., 2018).

The literature review in this thesis will focus on STIs to interpret the power of energy infrastructures, as mentioned by Bridge et al. (2018). This research focuses on the perspective of STIs that, in addition to economic and technological progress, incorporate socially shared values and norms and the embeddedness in the social, political, historical, and cultural orders in shaping perceptions and paths towards low-carbon transitions.

The sociotechnical imaginaries approach will be adopted because it will allow us to identify multiple imaginaries that are differently produced, mobilised, and justified by diverse stakeholders (Carvalho et al., 2022). More specifically, the concept of STIs is included, as this thesis aims to unravel how different actors and policies envision the transition to solar energy development. In this regard, Jasanoff and Kim (2009) elaborated on the concept of STIs as 'collectively imagined forms of social life and social order reflected in the design and fulfilment of nation-specific scientific and technological projects' (Jasanoff and Kim, 2009, p. 120). Therefore, technology allows people to imagine new social structures, as an imaginary is a form of a societal vision of an idealised future (Spijkerboer et al., 2022). STIs are collective perspectives on desirable futures (Jasanoff and Kim, 2009). However, there has been a shift away from the idea that the state plays a key role in achieving predetermined futures (Carvalho et al., 2022) toward the notion that a variety of stakeholders, including businesses, social movements, and professional societies, can co-produce and spread STIs (Jasanoff and Kim, 2009; Carvalho et al., 2022; Skjølsvold et al., 2020). In doing so, technology transforms into a sensible medium and a way for individuals to realise their aspirations (Bridge et al., 2018).

This research helps to find multiple visions among various actors by focusing on STIs of sustainable energy. Following Carvalho et al. (2022), pointing out contrasts between the numerous visions can reveal how socio-technical imaginations are created, mobilised, and justified in various ways and how futures are co-produced. Cozen et al. (2018) state that how

we communicate, think about and use energy will determine a sustainable future. STIS can increase public support and discover integrated socio-technical solutions, including a just and inclusive transition, when co-production and the inclusion of multiple stakeholders with varied imaginaries are combined (Echevarria et al., 2022). The STIs can influence new policy strategies that increase public support and address the essential difficulty of achieving a just and equitable result when moving towards carbon neutrality (Echevarria et al., 2022). This emphasises the state's and professionals' role in developing fair and equal STIs, which is of particular importance to the study.

To investigate STIs methodologically, an approach is incorporated to make the concept analytically traceable. Jasanoff and Kim (2015) attempted to interpret STIs. Jasanoff and Kim (2015) recommend three main methodological approaches. In the first approach, the authors promote using archival research to look at old writings, texts, and stories that show societal ideals and fantasies about how technology and society might develop in the future. By examining these archives, researchers can learn about the main sociotechnical imaginaries that prevailed in a particular time and context by examining these archives. This method enables a thorough comprehension of the historical growth and change of imaginaries. More research incorporates the second approach, which is discourse analysis. Discourse analysis examines the stories, arguments, and language that various actors use to create sociotechnical imaginaries. Researchers can pinpoint the discursive formations and power dynamics that affect the creation of sociotechnical imaginaries by looking at how different stakeholders express their future views and understandings. This method aids in illuminating the underlying social and cultural processes that influence society's and technology's collective imagination. Alda-Vidal et al. (2023), Delina (2018), and Levenda et al. (2019) use discourse analysis to generate findings around major themes that are reflected in the data that was recruited. In order to obtain actual data on public opinions, values, and attitudes towards technology and society, Jasanoff and Kim (2015) also suggest using social survey methods. Researchers can gather people's beliefs, expectations, and goals surrounding sociotechnical imaginaries using surveys, interviews, and questionnaires. This method makes it possible to pinpoint the various imaginaries that exist and the social forces that shape them.

This research focuses on a framework in accordance with discourse analysis. More particularly, to provide a framework to make sense of STIs and the role of actors, the STIs framework developed by Markard et al. (2012) will be incorporated. This framework can be subdivided into themes in the analysis. In the framework of Markard et al. (2012), the vision of the future and the role of actors are highlighted as the dimensions of STIs. The first dimension, the vision of the future, consists of discourses describing the expected impacts of

technology and how they might affect more critical social, economic, and environmental objectives. Visions use stories, narratives, or scenarios to show how people communicate their thinking to others with a focus on the future. These stories, narratives, or scenarios can be useful in mapping a range of plausible alternatives and the means for getting there, specifying pertinent stories that can bring together various stakeholders, capital, knowledge, and other resources, and providing a heuristic method for identifying specific problems that must be resolved in order to realise a vision (Sovacool et al., 2020; Berkout, 2006).

Jasanoff et al. (2007) assert that this dimension offers a suitable interpretive framework within which to address concerns regarding the significance of technological progress, their connections to social and political institutions, and the implications of the technology's social embeddedness. Furthermore, the framework of Lee and Byrne (2019) can be related to the STIs framework of Markard et al. (2012). Lee and Byrne (2019) state that the modern energy system is reinforced by social, economic, and technical visions that dominate the policy decision system. This is in line with the idea that with the use of technology, new social structures can be imagined (Jasanoff and Kim, 2009). As described by Markard et al. (2012), the vision of the future includes the expected contribution to broader environmental, social, and economic goals, which corresponds with the ideological pillar of visions (Lee and Byrne, 2019). Besides, Kousksou et al. (2015b) argue that decision-makers must prioritise technological maturity, economic viability, social acceptability, and environmental safety in managing RE development. The focus on the social, technical, environmental, and economic aspects of infrastructure indicates that these factors play an important role in the development of visions regarding energy transitions and are therefore included in this research.

The second dimension of STIs identified by Markard et al. (2012) is the role of actors. Within the dimension of the role of the actor, multiple underpinnings can be placed. This dimension mainly focuses on the various stakeholders and how they are involved in forming STIs and on how the process is designed (Markard et al., 2012). First, top-down, authoritarian decision-making is used for the technical rationalisation of extensive energy infrastructure. At the same time, non-technical and non-economic valuations are, therefore often not involved in decision-making (Lee and Byrne, 2019). In addition, new visions of sustainable development are heavily underpinned by technological solutions without taking justice and social implications seriously (Ha and Byrne, 2019). The ideal has frequently been expressed by consultants, modellers, and planners who contend that sustainability necessitates a technical comprehension of our issues and is, therefore, best left to professionals to unravel. Furthermore, socio-technical conceptions of extensive sustainable energy development are grounded in experts' ideas of fairness. It can be used to justify the use of large-scale energy

technologies that, while technically efficient, do not involve significant environmental and social conflict (Lee and Byrne, 2019). The decision-making process is centred on persuading society that there is no other option than to support the ongoing development of RE infrastructure because RE infrastructures need policy commitment. Anything less is thought to put social progress and economic growth at risk (Lee and Byrne, 2019).

To understand STIs in policy, the framework for visions of the future can be broken down into a few factors. The framework in this research will focus on the desirable vision of the future linked to the ideas of social order, the desired outcome of the technology, and the related impacts on the social, environmental, and economic situation. The other dimension incorporated in the framework is the role of actors, which focuses on the vision of policy regarding public involvement and governance. Figure 5 shows the two dimensions of STIs and the underpinnings of the dimensions related to RE development.

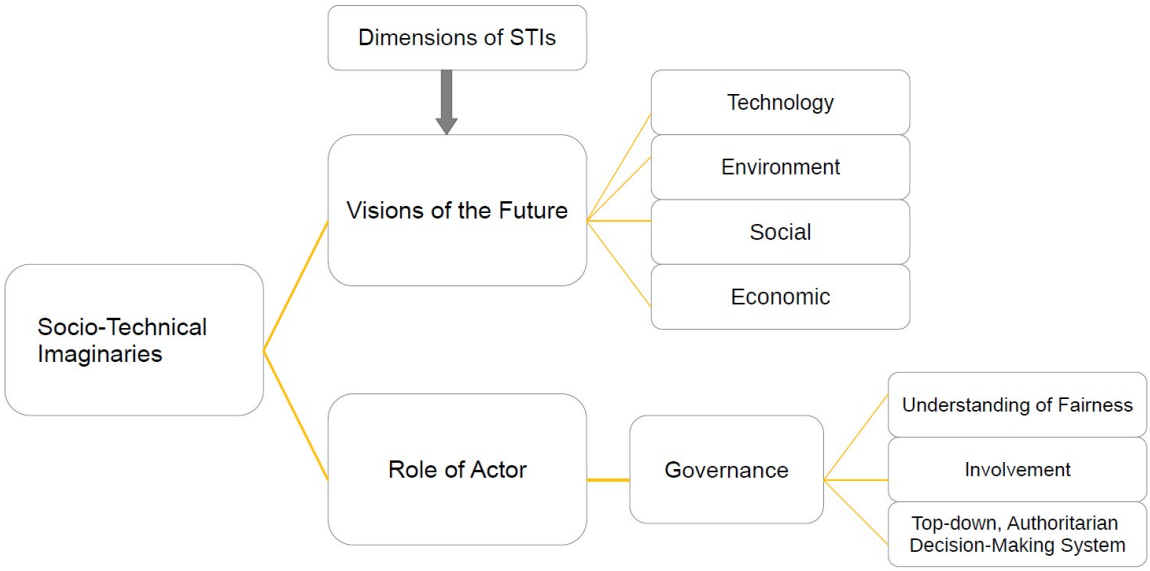

Figure 5: Socio-Technical Imaginaries Framework (Source: Author)

Even if STIs can be used to justify infrastructure projects as symbols of state power and forward-looking progress, the political implications of the project cannot be determined merely from their external structure. They elicit complex emotional commitments that result in a counterintuitive response (Larkin, 2013). What follows is why social acceptance lags as solar energy development is also opposed.

2.3 Shed a Light on the Solar Development Conflicts

In this section, I will discuss the issues with implementing solar energy infrastructure. As STIs are not universally shared, they are often contested and in competition with alternative

imaginaries of the power of technology to help society (Levidow and Raman, 2020; Richter et al., 2017). This section also focuses on the determinants of social acceptance of RE development and helps to establish a link with social acceptance of RE development. What follows is an account of why solar energy development is opposed.

Multiple reasons for opposition to solar energy development can be identified since the siting of large-scale solar projects is nonetheless often debatable (Outka, 2012). The notion of energy and space accentuates a conflict in land use, specifically between land accessibility and access to energy (Spijkerboer et al., 2022). It can affect both changes in land use itself, but also the land can be affected by the energy extraction process. Implications for land use from the switch to RE is the resurgence of the role of land for agricultural production. Particularly in rural areas that heavily rely on subsistence agriculture, land is a valuable resource for a living and a constraining factor (Hanger et al., 2016). According to Mulvaney (2013), the technology used to gather solar energy has enormous land use footprints. Due to this physical constraint, there may be conflicts between the deployment of solar energy and other uses of the land, as well as potential harm to ecological and cultural values. RE infrastructure also affects the land through the energy extraction process. Kurkute and Priyam (2022) demonstrated that each CSP technology requires a significant amount of water and land area per unit of power produced. Yenneti et al. (2016) pay special attention to the strategic land acquisitions that result in displacement, increased precarity, and perceptions of injustice among indigenous communities, as well as the enclosure of commons, restriction of access to land, and use of a variety of instruments of power (by state and non-state actors). The complicated interactions between community, energy, and land dynamics lead to opposition to solar energy development.

Access to land and its usage is related to the valuing of the land. As the valuing of land is also subsumed in the impact of decision-making, it is also an example of differences in values and beliefs. In addition, the differences in the discourse of the government and daily experience of livelihood are addressed by Ryser (2019). Researching the gap between the government's discourse, expert visions and the local daily experience will help to understand the implications of a transition. This interpretation of Ryser is in line with Moore (2017), who asserts that a failure to comprehend the social and justice ramifications of RE projects might result in misunderstandings of sustainable development and opposition to solar development.

Besides the conflict regarding land use, the distribution of economic risks and rewards affects how well a project is received by the community (Devine-Wright, 2005). According to Hanger et al. (2016), factors contributing to community approval include the distance from

the proposed power plant, awareness, public involvement, trust, and perceptions of fairness. Within the factors Wüstenhagen et al. (2007) identified as impacting community acceptance, the explanations of Mulvaney's (2019) issues regarding social acceptance can be grouped into trust, fairness, and procedural justice. Mulvaney (2019) discusses the structure of public participation, the acceptability of the impact of decision-making, the degree of self-interest, Not in my backyard, differences in values and beliefs, the degree of stakeholder collaboration, and inequitable power relations as a framework for determining whether social acceptance is achieved.

The concept of not in my backyard (NIMBY) explains the mobilisation of local populations to protest environmental or construction threats to their communities (Hager and Haddad, 2015). Externalities of RE, including aesthetics, noise, and impact on the local ecosystem, contribute to local community pushback, often classified as the NIMBY problem (Levenda et al., 2021). The factor of distance to the solar development site identified by Hanger et al. (2016) can be contextualised by NIMBY. The NIMBYism concept is a response that does not consider environmental justice and broadly includes opposition, mainly regarding aesthetics or property value (Outka, 2012). Additionally, Hanger et al. (2016) argue that the closeness of concrete projects can lead to local opposition. Wüstenhagen et al. (2007) illustrate this by stating that the relative visual impact of RE tends to be greater than in the case of fossil or nuclear energy that is situated underground and is not as apparent in our daily lives. This means that RE conversion tends to happen closer to where the energy consumer lives (backyard), increasing its visibility and bringing the environmental impact closer to their residence.

The impact of the decision-making focuses on the valuing of land, as there are different perspectives on the impact of RE development in the context of decision-making. Koch (2021) claims that deserts are frequently described as empty to justify their conversion to solar energy plants or locations for exploitation. Land acquisition on a large scale for solar production has an influence on resources for livelihood (Hanger et al., 2016). Houdret et al. (2017) draw attention to the conflict over land ownership in the Middle East and North African nations. This point of view is shared by Hanger et al. (2016), who note that land is a vital resource for sustaining livelihoods and is thus a barrier to the acceptance of solar development. Ryser (2019) addresses how the state and other actors play a part in creating a narrative that places a low value on land and how solar development might boost that value while concealing the loss of land and livelihoods. This is consistent with the claim made by Hanger et al. (2016) that the MENA region is portrayed as having sparsely populated deserts that offer abundant land. The low value of land plays an important role in the process and the acceptance of solar development. In line with the research mentioned

above, Outka (2012) claims that the process of siting large-scale solar projects is frequently contentious as the value and rights to land can lead to impacts on the local communities. This was the case in the Charanka community in India. Yenneti et al. (2016) case study in India shows that the interpretation of the value of land and the associated impacts on the local community are outweighed by the positive promises of the development of solar infrastructure and influenced decision-making. A major portion of the solar park was built on a government-owned wasteland. The interpretation of the government's ‘waste land’ usage is important because had the land been officially categorised as pastoral or grazing land, it would be defined as a common property resource by law, and hence the villagers would have had a permanent right to usage for previously grazing and farming.

Mulvaney (2019) also highlights the power relation as a factor that can oppose or help accept solar development. Procedural justice comes to the fore here. To maintain procedural fairness, all stakeholders must participate in energy decision-making democratically and fairly. Moore (2021) can reconfigure Mulvaney's position. The power dynamics between the powerful and the local community may cause opposition to top-down approaches applied in the case of large-scale solar development. Less engagement, unequal distribution of benefits from decisions and incentives, and decreased openness, notably concerning financial matters, could result from the top-down approach (Ryser, 2019). Furthermore, Haddad et al. (2022) note that large-scale initiatives rarely permit co-design or involvement in discussing the participation structure. In this respect, Haddad et al. (2022) also point out that in most cases, large-scale RE projects have been implemented top-down without much public involvement, echoing the arguments by Ryser (2019), Moore (2021) and Mulvaney (2019). In their study on Rajasthan, Sareen and Kale (2018) highlighted that ordinary people were not involved in setting the path for the energy sector. The process was underpinned by fragmented accountability relationships that enabled the reproduction of power relations. To further explain unequal power relationships, it may be said that decision-making in socio-technical transition is power-ridden, which raises concerns regarding social acceptance (Lawhon and Murphy, 2012). An illustration of unequal power relations and how they affect opposition to RE efforts comes from the Global South. Rignall (2016) points out in her research that in Morocco, the unequal relations between the marginalised population and the governance structures clearly lead to power over collective land by officials, with no say from the local population, leading to questions regarding social acceptance.

The level of stakeholder cooperation is another determinant of community acceptance. Through collaborative planning between resource agencies and the local community, the use of solar energy can be encouraged, which would also help solve any environmental justice issues (Mulvaney, 2019). According to Azeroual et al. (2018), the introduction,

success, and acceptability of RE development in Morocco were impacted by the lack of cooperation, synergetic teamwork, and coordination between the political groups and ministries.

As mentioned by Wüstenhagen et al. (2007), trust is also part of the dimension of community acceptance, which is not specifically mentioned by Mulvaney (2019). According to Hanger et al. (2016), establishing trust is essential for fostering social acceptance. A real-world illustration can support his claim. Local distrust in NGOs and governmental actors in Ouarzazate in Morocco has led to an uproar in the social acceptance of solar panel park Noor. The lack of transparency regarding the use of funds and the advice to submit official requests that either received no response at all or none promptly led to the distrust. Furthermore, it was caused by the idea that governmental actors and NGOs have access to the advantages of solar energy development disproportionately compared to local citizens (Ryser, 2019).

2.4 Conceptual Model

Figure 6 gives a schematic view of the synthesis of the theoretical framework. The conceptual model underscores the interplay between STIs, policy dynamics and the real-world implications of STIs. The conceptual model shows that STIs can influence both the policy that can steer a rapid transition regarding renewable energy and impacts the social acceptance and the way other stakeholders, like the local community, view the implementation of solar infrastructure development. STIs can affect the policy strategy as the imagined forms of social life are reflected in the design and fulfilment of technical projects (Jasanoff and Kim, 2009). These technologies in the form of energy infrastructure can be a point of discussion in the acceptance and alignment of STIs of solar energy between various stakeholders, as STIs are not universally shared and can be contested by alternative STIs (Levidow and Raman, 2020). Echevarria et al. (2022) state that STIs can influence opposition to solar energy infrastructure and raise public support for integrated socio-technical solutions, such as a just and inclusive transition. The model predicts that the misalignments between expert visions and policy-oriented imaginaries will have real-world effects for stakeholder engagement, policy performance, and public perceptions of the development of solar infrastructure.

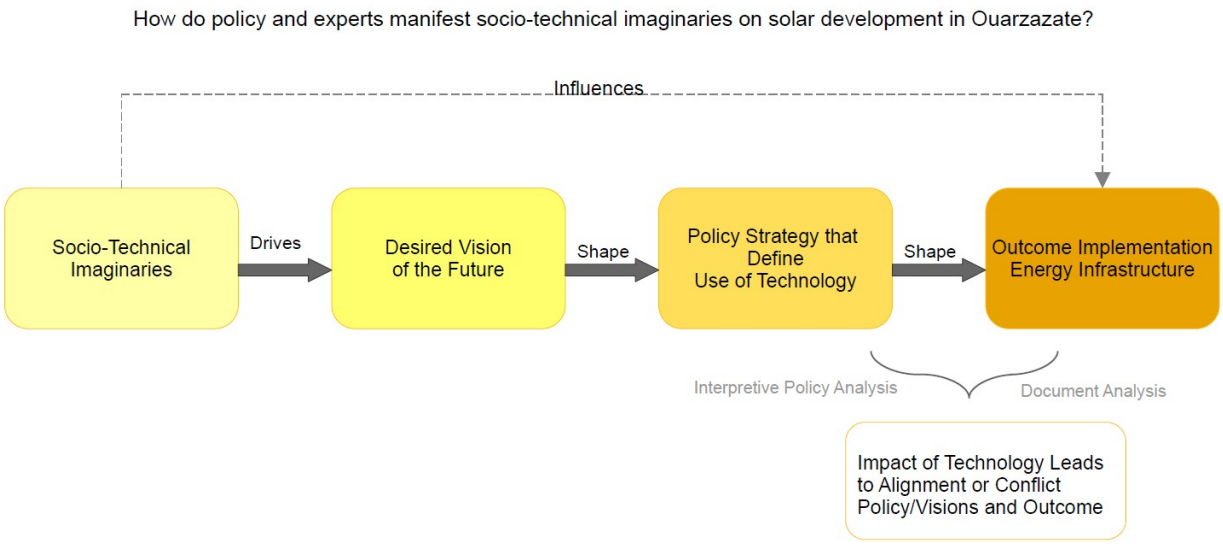

Figure 6: The Influence of STIs on Renewable Energy Policy (Source: Author)

3. Methodology: Analysing Policy and Documents

3.1 Unit of Analysis

The unit of analysis, or the case study, is determined by defining its spatial boundary, theoretical scope, and timeframe (Yin, 2017). The spatial boundary of this case study is the Noor Ouarzazate solar complex near the Pre-Saharan city of Ouarzazate in southeast Morocco (Ryser, 2019) and is showcased in Figure 7 by an orange dot. Aligned with climate change and the energy transition, Morocco has shifted towards an ambitious target for wind and solar power energy (Komendantova, 2016). The Kingdom of Morocco launched the Morocco Solar Plan (MSP) in 2009, which is characterised as an ambitious ten-year plan to become a major global solar energy producer (Rignall, 2016). In the case study area, the MSP was presented as a model for different countries in the Global South (Haddad et al., 2022). Furthermore, Noor Ouarzazate is one of the world's largest solar power projects that has attracted the attention of various experts and involved policymakers (Cantoni and Rignall, 2019). The case study allows this research to analyse diverse perspectives and potential tensions that arise from their differing visions. Therefore, the case study matches the aim of the research since it helps with understanding the STIs regarding solar energy development envisioned by experts and policy and examines whether there are conflicts between these visions and the actual developments in Ouarzazate.

Figure 7: Case Study Location (Source: Mapsland, n.d)

3.2 Research Design

Using multiple data collection techniques helps to understand how the STIs formed by policy and experts impact the outcome of solar technology. This thesis uses case study research to understand the roles of STIs of experts and policy in imposing solar energy complexes. To answer the leading research question calls for a specific type of research design. Qualitative data methods can be used because they can grasp the complex and various subject perspectives of the case study of Ouarzazate (Gaudet and Robert, 2018). Due to spatial constrictions, the research is conducted in the Netherlands from February to August 2023. Data collection relies on a mix of various qualitative data collection techniques (Yin, 2017). In this research, interpretive policy analysis and document analysis are used as data collection techniques.

For the interpretive policy analysis, the data has to determine the vision for RE in the national policy of Morocco and how the STIs regarding RE are framed. This method can help answer the following research question: “How does policy frame the socio-technical imaginaries of solar energy development in Morocco?”. Interpretive policy analysis assists in understanding how values, interests, and political contexts underpin policy decisions and

outcomes (Browne et al., 2019). Therefore, this research includes interpretive policy analysis. The presentation of this method by Browne et al. (2019), as examining the framing and representation of problems and how policies reflect the social construction of ‘problems’, fits with the purpose of understanding the framing and representation of the policy.

The use of document analysis will help to systematically evaluate documents and to answer the following research question: “What are the socio-technical imaginaries held by experts that informed the development of the Noor Ouarzazate solar energy project?”. This method offers some freedom because both printed and electronic materials can be used. Document analysis requires that data be examined and interpreted to elicit meaning, gain understanding, and develop empirical knowledge (Bowen, 2009). Furthermore, document analysis is applicable as a research method focusing on qualitative case studies, producing an intensive and rich description of a case study (Yin, 2009; Bowen, 2009). The aim of the document analysis is to shed light on the STIs of solar energy infrastructure from different experts.

3.3 Data Collection and Analysis

To answer the research question: “How does policy frame the socio-technical imaginaries of solar energy development in Morocco?” an understanding of the STIs in Moroccan policy is provided by conducting an interpretive policy analysis. The chosen policy documents and the analysis framework will be elaborated in section 3.3.1. Document analysis will help to answer the second research question: “What are the socio-technical imaginaries held by experts that informed the development of the Noor Ouarzazate solar energy project?” The document analysis includes news articles, reports, press reports, conferences, and interviews.

3.3.1 Interpretive Policy Analysis

To perform the interpretive policy analysis, four national policy documents are selected, one focusing on a specific land acquisition plan of the case study area. The Moroccan National Energy Strategy (NES) and Nationally Determined Contributions Morocco (NDC) outline the overarching goals, targets, and strategies for developing RE in Morocco. Both policy documents provide a comprehensive roadmap for transitioning the country's energy mix towards cleaner sources and reducing its dependence on fossil fuels. The document highlights the government's commitment to RE, identifies priority sectors and technologies, and sets specific targets for capacity installation, energy efficiency, and carbon emissions reduction. Analysing this policy document can provide insights into the government's long-term vision, policy priorities, and the socio-political context driving RE development in Morocco. The Moroccan Solar Plan (MSP) is a specific policy initiative within the (NES) that

focuses on solar energy development. It harnesses Morocco's solar potential and promotes the deployment of large-scale solar power plants nationwide. The plan includes multiple phases, such as the construction of concentrated solar power (CSP) and photovoltaic (PV) projects and initiatives for research, development, and capacity building in the solar energy sector. Analysing the Land Acquisition Plan (LAP) can provide insights into the technological choices, economic considerations, and social implications of large-scale solar energy projects, as well as the role of international collaborations and partnerships in implementing such initiatives. The policy documents used for policy analysis are listed in Table 1. As the policy strategies are provided in French, they are translated using the translation program Google Translate.

Table 1: Selected National Policy Documents Renewable Energy Morocco (Source: Author)

Title of the document, Year	Timeframe	Jurisdiction	Focus	Author
National Energy Strategy (NES), 2009	2009 up to 2030	National	Energy efficiency Renewable energy	Royaume du Maroc and Ministère de l'Energy, des Mines de l'Eau et de l'Environnement.
Morocco Solar Plan (MSP), 2009	2009 up to 2020	National	Development of solar energy industry	Royaume du Maroc
Morocco first Nationally Determined Contribution (NDC), 2021	2021 up to 2030	National	Nationally determined contribution for the period 2020-2030 regarding renewable energy, per the Paris Agreement	Ministère de l'Energy, des Mines et de l'Environnement
Land Acquisition Plan (LAP), 2011	2010 up to 2030	National	The impacts of land acquisition for the constitution of achieving the construction of a solar energy production complex	MASEN: Moroccan Agency for Sustainable Energy (MASEN)

To investigate the STIs in Moroccan policy regarding solar energy, the analysis uses two dimensions of STIs. This research uses the visions of the future and the role of actor dimensions are used. To structure the analysis, the visions of the future dimension are divided into several factors. The following factors are used: technology, environment, society, and economy because RE infrastructure impacts these factors (Terrapon-Pfaff et al., 2021). In addition, some other studies have implemented these factors (see Markard et al., 2012; Terrapon-Pfaff et al., 2021; Kousksou et al., 2015b). The analysis includes all factors, and it analyses how the policy describes the impact of the solar RE infrastructure on the mentioned factors to understand the STIs envisioned in Moroccan policy documents.

3.3.2 Document Analysis

The process of document analysis starts with selecting the relevant documents for this analysis. For the purpose of this research, the relevance of the documents should follow a linkage to STIs on solar energy infrastructure given from an expert perspective or social expert perspective. The selected documents include both the technical and the social side of solar energy and the impacts of solar energy development in Morocco. Besides, most articles include the direct vision of an expert agency or a solar expert, formulated, documented, published or published. The timeframe of the included documents is from 2009 to 2023. The reasoning behind this selection is the inclusion of the start of the implementation of the Morocco Solar Plan, the realisation of CSP projects and some years after the completion of the Noor project to get the best possible picture of expert STIs. In Table 2, the selected documents are listed and categorised in news articles, reports, and opinion pieces.

The data are collected from online resources. With the help of Nexis Uni®, PressReader, and Google News, the documents are collected. Nexis Uni® provides access to a reliable online newspaper archive. The database contains current and historical information from national newspapers and international news (LexisNexis, 2023). PressReader is a facility of libraries to access news articles or journals from all over the world. To find suitable documents, the organisations that play an important role in the development of solar infrastructure in Morocco are included in the search process. The organisations of interest are the Moroccan Agency for Sustainable Energy (MASEN), Research Institute for Solar Energy and New Energies (IRESEN), Moroccan Energy Observatory (MEMEE), The Moroccan Agency for Development of Renewable Energy and Energy Efficiency (ADEREE), and National Office of Electricity and Drinking Water (ONEE).

Table 2: Selected Documents for Document Analysis (Translated Titles) (Source: Author)

Type of Document	Author and Title

News articles	• Arab Times. (2013) Morocco Seeks Energy Salvation in Sunshine, Wind - Govt Launches Solar Plan with Ouarzazate Contract • Khaleej Times. (2017) Morocco's Clean Power Revolution • Kingdom of Morocco. (2021) National energy strategy • Le Matin. (2020) Noor Ouarzazate: Inauguration of a thermal storage system • Mouttalib, M. (2017) Renewable Energies: MASEN Keeps its Targets for 2030 • New Strait Times. (2016) Solar Plant Pride of Morocco • Oliver, M. (2023) The African nation that could be the world's first renewables superpower • Penticton Herald. (2016) Sun Harvested for Energy • The Business | year. (2020a) Saïd Mouline, CEO Moroccan Agency for Energy Efficiency Interview • The Business l year. (2020b) Solar Superpower- Focus: Taking the Lead in Renewables • The Malta Business Weekly. (2015) Moroccan Solar Plant to Bring Energy to Million People • The World Bank. (2015) A Brighter Future for Morocco's Interior Powered by the Sun
Reports	• African Development Bank Group. (2012) Summary of the Environmental and Social Impact Assessment: Ouarzazate Solar Power Station Project ll • Falconer, A. and Frisari, G. (2012) San Giorgio Group Case Study: Ouarzazate l CSP • Independent Evaluation Group. (2021) MA-Ouarzazate Concentrated Solar Power - Implementation Completion Report • MASEN. (2017) MASEN Press File - MASEN Endless Power for Progress
Opinion Pieces	• Aoui, A., el Amrani, M., A., and Rignall, K. (2020) Global Aspirations and Local Realities of Solar Energy in Morocco • Hamouchene, H. (2016) The Ouarzazate Solar Plant in Morocco: Triumphal 'Green' Capitalism and the Privatisation of Nature • Salime, Z. (2021) Life in the Vicinity of Morocco's Noor Solar Energy Project • World Resource Institute. (2021) Morocco: Ensuring A Large-scale Renewable Installation Benefits Local Communities

The documents are analysed to find the desired vision of solar energy development in Morocco. The analysis uses a wh-question framework to discover visions of solar energy. Wh-questions are used to seek content information relating to persons, objects, place,

reason, time and manner (Rochester Institute of Technology, n.d). The wh-questions used in this research include: What? Who? Where? When? and How? By asking these questions, expert visions, the level to which the vision relates, and when and how the vision will be realised can be found. The what? question includes the STIs of solar energy in Morocco. Who? indicates the expert organization or role by whom the STIs are pronounced. The where? question on which level the STIs are applicable. When? states the year of the release of the STIs, and lastly the How? question includes the ways and visions on how the STIs can be implemented.

3.4 Ethical Considerations

This study involves analysing sensitive policy documents and documents that reflect the viewpoints of various experts. Some ethical considerations are applied in this research. When using the selected documents, it is vital to keep in mind bias and subjectivity and the interpretation of the documents. To maintain objectivity and integrity, it is crucial to remain aware of potential biases within the literature, documents, and policies and my own position as researcher. Given the cross-cultural nature of this research, it is important to be sensitive to cultural nuances and potential misinterpretations. Therefore as researcher, I tried to strive to understand the cultural context and implications of this research. Furthermore, acknowledging the sources by referencing the documents and policies in the research is essential to give credit to the authors. Lastly, it is helpful to consider the diverse perspectives even if it is hard to gain primary data to provide a comprehensive understanding.

4. Results: The Solar Vision of Morocco

This chapter describes the findings. First, it addresses background information about Morocco, which includes the demographics, geographical characteristics, colonial history, and the governance of the Kingdom. This is followed by explaining the emergence of a solar development vision for Morocco and what the future holds for the country. After this, the collected data is displayed in tables. Both the interpretive policy analysis and the document analysis are shown separately. After a summary of the findings, both analyses will be compared to see if there are any alignments or conflicts between the visions and the outcome.

4.1 Morocco Demographic, Geographical, Historical, and Governance Background

To create more understanding of the case study area, the establishment of the CSP solar infrastructure in the case study area, and before settling on a location for the CSP plant, some issues such as geography, governance, demography, history should be examined. Subsequently, recent strategies deployed by the government for sustainable development were reviewed and discussed.

The Kingdom of Morocco is located in the Maghreb region (the West) of Northwestern Africa and spans an area of 446,300 km² (The World Bank, 2020). Because of its location, Morocco is both the gateway to the Arab world and a strategic location on the edge of the continent of Europe (CountryReports, n.d; The World Bank, 2020). The Kingdom is known for its various geographies, climate, population, and customs (Jeffreys, 2012). The governmental and institutional structure was written under the French civil code after Morocco became a French protectorate in 1912 (Bertelsmann Stiftung, 2022).

In July 2023, the country had a population of 37,840,044 (World Population Review, 2023). Morocco is composed of Arabs and Imazighen (also known as Berbers). The Amazigh population is estimated to comprise 40% of Morocco's population. Before the recognition by King Mohammed VI, the Amazigh population had long campaigned for the recognition of their political, economic, social, and cultural rights and against their marginalisation and exclusion from access to education and media (Bertelsmann Stiftung, 2022).

Morocco's geography varies considerably across the country's northern to southern areas (World Bank Group, 2021) and is presented in Figure 8. The country's coastline and plains span the Mediterranean Sea and the Atlantic Ocean. In the interior, a large part of the terrain

of Morocco is mainly mountainous. The south is lined with the Sahara desert (Britannica, 2023; World Bank Group, 2021). Morocco's climate is as varied as its topography. This results in a Mediterranean climate with mild, wet winters and hot, dry summers along the coast (World Bank Group, 2021). The eastern slopes of the Atlas Mountains are characterised by semi-desert aspects and a rigorous pre-Saharan climate (CountryReports, n.d).

Figure 8: Geographical Map of Morocco (Maps of World, 2023)

The complex terrain with a semi-arid climate is mainly inhabited by the Berber people. (Mejdoul and Taqi, 2012). These rural, mountainous areas are less accessible parts and have been the least developed areas. The distribution of the Moroccan population is shown in Figure 9. The Moroccan Berbers are traditionally concentrated in the Rif Mountains in the North, southeast of the High and Mid-Atlas Mountains, the Anti-Atlas Mountains in the southwest, and in the Souss Valley in South Morocco (Aslan, 2014).

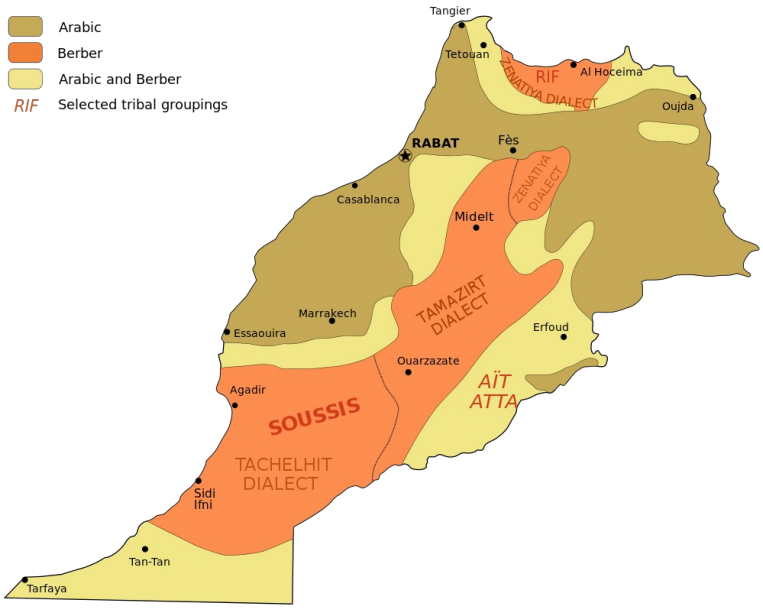

Figure 9: Distribution Arab and Berber Population in Morocco (Source: Central Intelligence Agency, n.d)

The Amazigh played an important role in the history of the country, as they acted against colonialism and the 44-year protectorate of France. This created a sense of pride, mainly because most land could not be dominated during the colonial era, as the strong local tribe hierarchy competed with the central rulers (Ryser, 2019; Aslan, 2014). During the protectorate from 1912 to 1956, the French modernised the political structure and focused more on the central authority's expanded reach (Aslan, 2014). Furthermore, the French policies made the king the symbol of Moroccan nationalism, which in the first years after the post-protectorate period, led to the idea of further centralisation and attempting to gain dominance over Berber territories, giving the king the upper hand in the political arena.
The French imagined a distinction between the Berber and Arab identities, as a result of which the Amazigh territories had autonomy until the end of the French protectorate (Aslan, 2014).

Nowadays, Morocco is an executive monarchy in which the king has the last political words. He is the head of the state (Bertelsmann Stiftung, 2022). In 2011, institutional reform in Morocco was supported to establish good governance (Benhlal, 2014). The incentive was to increase the role of the parliament and the government. However, there remained a dominant position for the royal palace, and it continued to channel its interests through the key institutions and the *Makhzen* (the elites loyal to the palace). As the king appoints the governors, they function as an extended arm of the monarch's interests (Haddad et al., 2022). In other words, the king and his *Makhzen* control decision-making (Bertelsmann Stiftung, 2022).

Although the constitutional reform of 2011 also increased the power of local governments, their capabilities have been quite limited (Haddad et al., 2022). The decentralisation reforms were introduced to strengthen participatory governance. However, they are still controlled by the central government, partly by the historical legacies of the centralised system (Bertelsmann Stiftung, 2022). This central control is mainly experienced in rural areas, where the governors chosen by the king have preserved their powerful position (Haddad et al., 2022). However, the role of NGOs in these areas is increasing in establishing a relationship between the rural community and the appointed state representatives (Bergh, 2009). Therefore it can be pointed out that Morocco is a liberalised authoritarian monarchy in which the regime uses democratic institutions to sustain an authoritarian regime and undemocratic practices (Bertelsmann Stiftung, 2022).

As this section has outlined some background, the next section will focus on the history, status, and outlook of Morocco's RE transition.

4.2 Solar Energy Development, Status, Potentials, and Outlook Morocco

There are several reasons behind the emergence of RE in Morocco.
Morocco had to deal with four principal challenges. First, the country has to deal with the increasing CO2 emissions. The national energy consumption of Morocco is still very based on fossil fuels. In 2019, almost 90 % of the total energy consumption came from gas, oil or coal (IRENA, 2022). Consequently, the outlook is that the total CO2 emissions will increase steadily as the rising energy demand in the mid-long term. The second challenge is the growing demand for a new electricity infrastructure system that is more stable and can cope with the project's growth in electricity consumption. The electricity demand increased with the economic development in Morocco (Azeroual et al., 2018). The average annual electricity demand growth rate in Morocco between 2010 and 2019 is 3%. However, a quicker growth was seen in 2021 when the total energy consumption rebounded by 7.5 % (Enerdata, 2023). Projections show that electricity consumption will quadruple by 2030, posing serious national energy security concerns (Vidican, 2015). To meet this rapidly increasing demand for electricity, it is suggested that Morocco must double its power generation capacity by 2020 (Falconer and Frisari, 2012). Thirdly, the electricity prices in Morocco are not uniform. The fourth challenge is the dependence on energy importation for the energy supply in Morocco. Morocco originally had few local energy sources, and therefore, Morocco’s energy profile is dominated by fossil fuels that are imported. As a result, more than 96% of the energy supply is sourced outside the country's borders (Azeroual et al., 2018; Kousksou et al., 2015a). Due to its reliance on energy imports,

Morocco is extremely vulnerable to increases in global fuel costs, placing a significant financial strain on the country's budget (Kousksou et al., 2015b).

Morocco outlined a unique course for reforming the power industry. In addition to these problems, there were several significant developments in Morocco's power sector starting in 2008. These changes include a national energy strategy release, additional liberalisation, the creation of implementing agencies, and the creation of a legislative framework. This was accomplished despite preserving a robust, state-owned, vertically integrated national power utility that served as a single buyer at the sector's centre (Usman and Amegroud, 2019).

Decree-Law No. 2-94-503, passed in 1994, added to the legal framework. According to this law, independent power generation projects with a capacity of more than ten MegaWatts (MW) were permitted. The earliest wind farms in the nation were a result of this. Law No. 12-03 on Environmental Impact Assessment was promulgated a few years later, in 2003. Projects involving wind and solar energy, however, were not included. The self-production threshold was raised to 50 MW in 2008 by Law No. 16-08, which also permitted the negotiation of private concession agreements for producing electricity from domestic energy resources (Cantoni, 2017). In 2010, a number of legislations were introduced. The first law tries to encourage RE while regulating exportation and commercialisation. Additionally, by granting access to the grid to producers of RE, allowing export, and allowing the construction of specialised transmission lines, Law No. 13-09 contributed to the opening up of the energy producing sector. The execution of agencies is a subject of other laws. ADEREE and MASEN were established as a result. MASEN is the most significant actor in terms of establishing a clear framework for solar projects, promoting, investing in, and financing projects, contributing to the growth of knowledge and research in the solar industry, and managing and overseeing the implementation of the solar programme. ADEREE focuses on the creation, organisation, and execution of programmes and projects, supporting governments with legislation and offering suitable locations for carrying out large-scale initiatives. Law No. 47-09 was passed in 2011 to improve energy resource consumption efficiency, lower energy expenses on the national economy, and promote sustainable development (Kousksou et al., 2015b).

These laws are part of the institutional framework of Morocco's power sector. In addition to these laws, the NES and the MSP policy documents play an important role in the reforms (Azeroual et al., 2018). The NES aims to increase energy access for all societal groups, foster the development of RE sources and energy efficiency, promote increased foreign investment in the European market, and diversify the fuel mix in the electricity sector (Kousksou et al., 2015b; Usman and Amegroud, 2019). Strong top-down policy directives have helped the power sector stay on track to meet these goals (Usman and Amegroud,

2019). The Morocco Solar Plan, which the Moroccan government unveiled in 2009, has the objective of installing 2000 MW of solar power capacity by 2020 through five CSP projects (Falconer and Frisari, 2012). The Kingdom of Morocco has set ambitious goals to grow RE sources and the energy industry. With a strong goal of obtaining more than 53% of its electrical energy from renewable sources by 2030, including 4560 MW of solar energy produced, Morocco's energy initiatives stand out significantly (Azeroual et al., 2018).

The focus on RE and the ambitious goals can be justified because Morocco has a lot of potential in the field of RE. Morocco, which is ranked ninth worldwide in terms of solar resources, has a significant amount of solar energy potential. The nation benefits from strong solar radiation with an average annual sunshine duration of 2700 to 3500 hours (see Figure 10) (Kousksou, 2015a; Kousksou et al., 2015b).

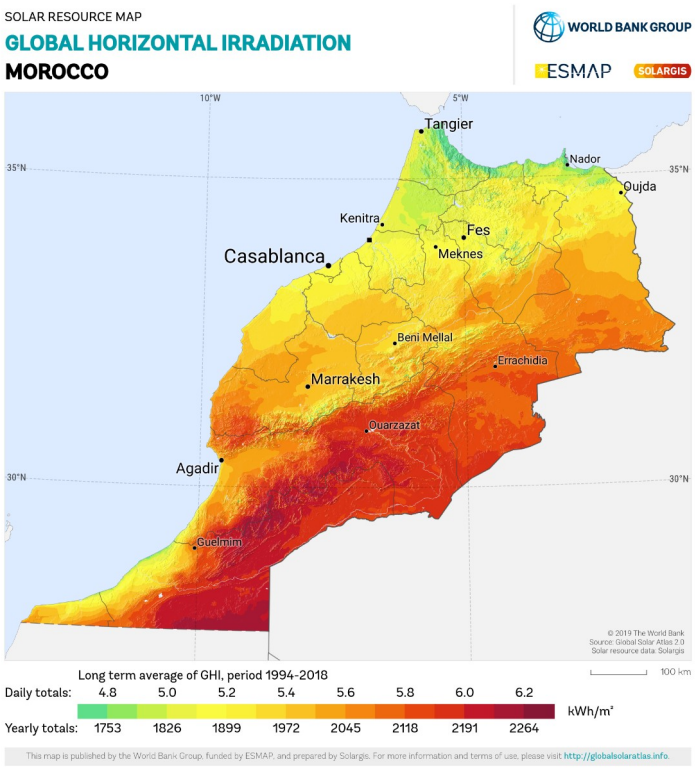

Figure 10: Average Solar Irradiation of Morocco (Source: The World Bank, 2023)

The development of five CSP projects is part of the MSP. Numerous variables, including topography, accessible infrastructure, and political and economic considerations, influence location choice. Geographical characteristics include that the terrain should be level (Kousksou et al., 2015b), uninhabited, and underutilised, as well as that the environment should be hot. Water should also be available because it will be used for cooling. A flat agricultural terrain like Ouarzazate made it possible to create solar energy (Climate

Investment Funds, 2019). Additionally, the city has a higher density and is surrounded by a less densely inhabited area (Abdelouhed et al., 2022). The Noor complex's chosen project site, according to MASEN, was not occupied. Therefore no displacement was necessary, and no culturally significant sites were harmed (World Resources Institute, 2021). The political and economic stability of the area where the CSP will be built, the cost of renting land, the ease of investing, the availability of a power purchase agreement, and finally, the existence of government incentive programmes are all things that need to be considered (Hanger et al. 2016). The cost of purchasing the land was reasonable (Rignall, 2012).

Considering these factors, CSP plants are best placed in the arid area around Ouarzazate (Hanger et al., 2016). Because of this, MASEN began to create the 500MW Ouarzazate Plant in 2009 (Kousksou et al., 2015a). The National Office of Electricity and Drinking Water purchased the 3,000 hectares of communal land in 2010 after MASEN assisted in a mutually agreed-upon transfer (MASEN, 2011; Rignall, 2012). The CSP plant after that started operating at full capacity in 2019 (Climate Investment Funds, 2019). Two technical variations of the idea are being developed: solar panels using photovoltaic technology and CSP solar thermal plants (Kousksou et al., 2015a). The initial capacity of Noor Ouarzazate, the largest CSP plant in the world, is depicted in Figure 11. When finished, it will have a capacity of 582 MW and an annual production of 1,150 GWh (Cantoni, 2017).

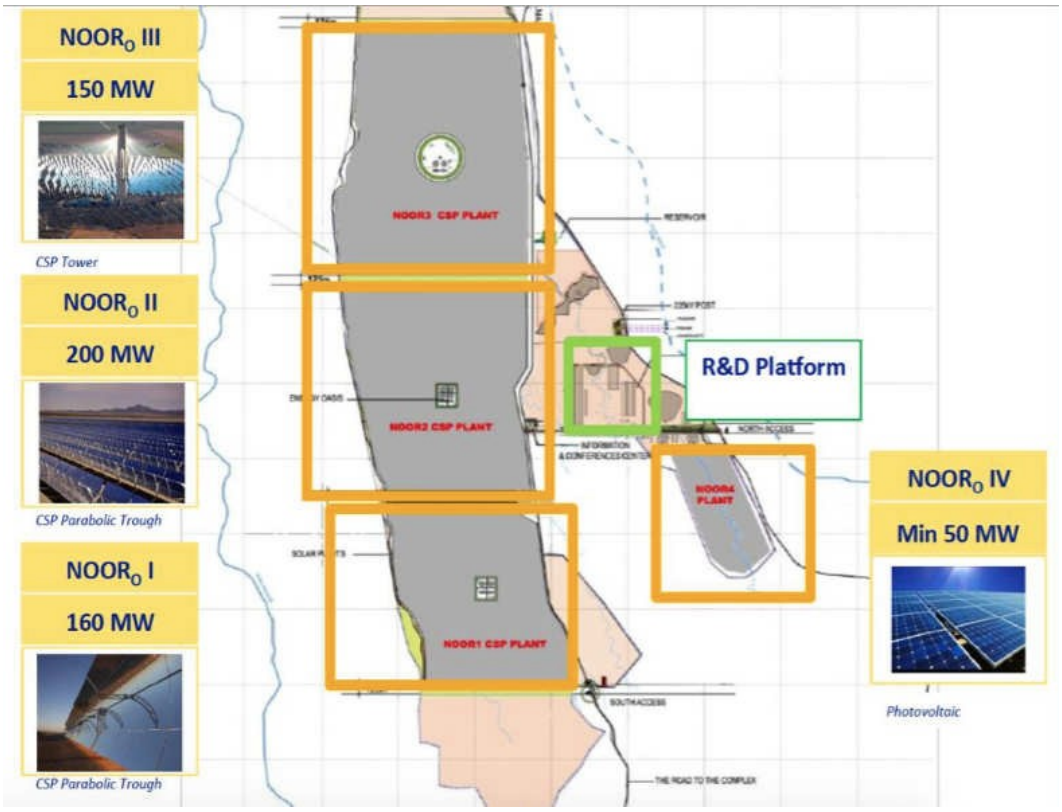

Figure 11: Noor Ouarzazate Project Stages (Source: Wuppertal Institute; Germanwatch, 2015)

Several stakeholders were involved in this project's finance and implementation of the CSP plant in Ouarzazate. First, different national agencies have diverse roles to play in ensuring the success of the NES and the Solar Plan. A number of entities has accelerated the shift to RE in Morocco. Projects for RE have been extensively pushed and coordinated in the nation by the Moroccan Agency for Sustainable Energy (ADEREE), the Moroccan Agency for Sustainable Energy (MASEN), and the Research Institute for Solar Energy and New Energies (IRESEN). The success of Morocco's RE sector has been aided by these institutions through partnerships, research and development, and the execution of government incentives and agreements (Cantoni and Rignall, 2019). The National Office of Electricity and Drinking Water (ONEE) also plays a role in realising the energy ambitions. Electricity is produced, transported, and distributed by the public utility ONEE. With three independent power providers, ONEE generates all of the energy used in Morocco and acts as a single buyer (Kousksou et al., 2015a). Additionally, according to Usman and Amegroud (2019), the Moroccan Agency for Energy Efficiency (AMEE) has the purpose of proposing national, regional, and sectoral strategies for the development of energy efficiency and coordinating their implementation.

Financing also involves several different stakeholders. Additionally, financing involves a variety of stakeholders. The Noor Ouarzazate project is funded by a public-private partnership and the participation of international funding organisations (Cantoni, 2017). The Moroccan government and MASEN, who will each pay 883 million US Dollar, are among the important parties. Their goals are to enhance the country's energy balance by reducing fossil fuel imports and to boost local economic growth locally by developing competence in the solar power sector (Falconer and Frisari, 2012). The African Development Bank Group, the Agence Française de Développement, the Clean Technology Fund, the European Commission, the European Investment Bank, Kreditanstalt für Wiederaufbau, and the World Bank provided international funding for the entire investment (Power Technology, 2020). A group of private developers has also agreed to build the Ouarzazate solar power plant and contribute financial resources and experience (Kousksou et al., 2015a; Falconer and Frisari, 2012). This group is led by the Saudi business ACWA Power International.

Solar energy is one of the most cost-effective types of RE (Kousksou et al., 2015a). Morocco has more than doubled its power supply since 1990. Figure 12 shows the solar thermal or CSP power increase from 2015 to 2021. According to the executive director of MASEN, Morocco is on pace to achieve its goals of producing 42% of its electrical power from

renewable sources by 2020 and 52% by 2030, as the nation generated 34% of its energy from renewable sources in 2017 (China Daily, 2018).

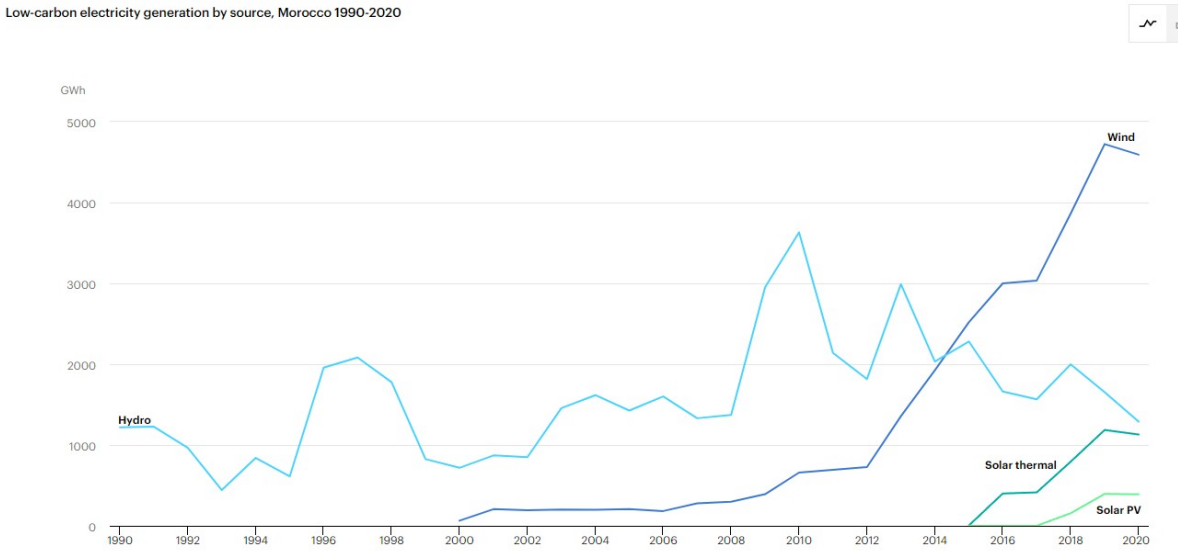

Figure 12: Growth of Solar Thermal Electricity Generation in Morocco (Source: IEA, 2023)

Also, the report of IRENA (2022) shows that the renewable capacity of Morocco is built by sun, wind and hydro energy. In addition, the report shows that the installed capacity of renewable infrastructure has grown with a renewable share of 30% (see Figure 13).

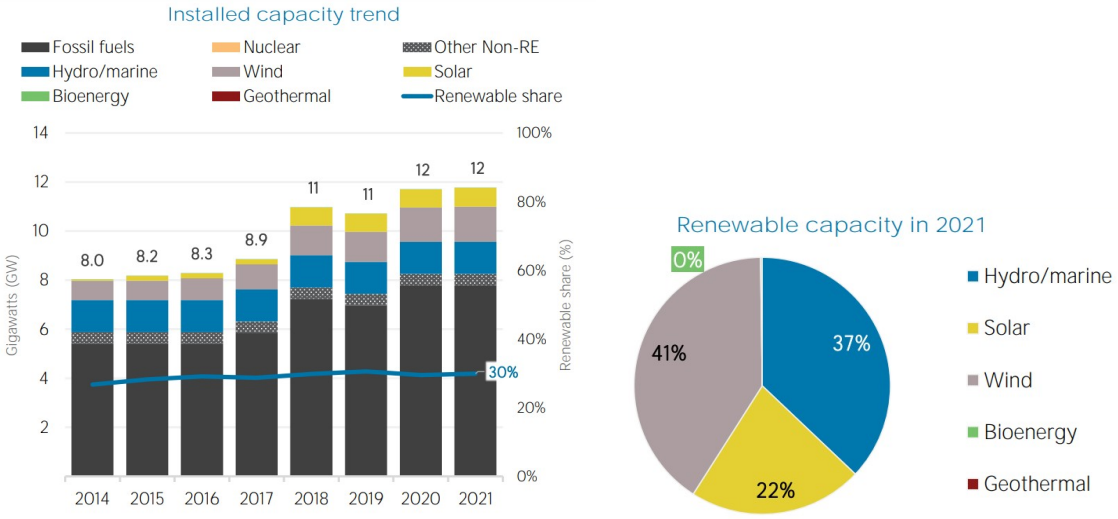

Figure 13: Renewable Energy Capacity Status Morocco (Source: IRENA, 2022)

4.3 An Interpretive Analysis of Solar Energy Policies in Morocco

In this section, the finding of the interpretive policy analysis are offering a comprehensive understanding of Morocco's desired visions for its solar energy future. Through an exploration of the different dimensions of STIs and their factors in various policy documents, a clear consensus emerges, underscoring the significance of solar energy as a transformative force for Morocco's energy landscape. These policy documents' STIs for the

future share some characteristics and differ slightly from one another. The policies under consideration, which include the National Energy Strategy (NES), Moroccan Solar Plan (MSP), Moroccan Updated Nationally Determined Contribution (NDC), and Land Acquisition Plan (LAP), are presented within the context of these dimensions, giving a succinct overview of their respective perspectives on Morocco's trajectory for solar energy. The different STIs and their similarities will be pointed out, and a summary of the findings is presented in Table 3.

4.3.1 The Desired Vision of Morocco's Solar Development

The results show that the desired futures of the different policies match but also differ. First, all policy documents recognise that the use of solar energy, the increasing generation of solar energy and diversification with a focus on solar energy is a desired future for Morocco. The NES and the MSP aim for energy security in Morocco, whereas the NES adds energy efficiency. Both the MSP and the LAP envision independence from imported fossil fuels in Morocco. This agreement is partly because the LAP carries out part within the MSP. The focus of the NDC of Morocco is more on the environmental issues the country is facing. It states that a solar energy future can help with increasing resilience to climate change and decreasing GHG emissions. In addition, the NDC explicitly states that a rapid transition to a low-carbon economy is required as a future vision.

The development of a future aimed at solar energy must, in any case, go hand in hand with the use of technology. All policy documents agree on the important role of technology and innovation for a solar future but differ slightly and correspond to the desired solar energy vision per policy document. For example, the NES states that human resource and scientific knowledge of RE technology is needed to implement reliable and competitive technology choices. The MSP argues that CSP technology is needed for development and satisfying energy needs and will strengthen Morocco's position as a top innovator. The NDC vision of technology corresponds to the desired future as the focus on the requirement of technology and the mobilisation of innovative solutions for adaptation and resilience. The LAP states that solar energy technology is needed to address energy import dependency, which is in line with a part of the desired future of the LAP.

The environment will be impacted in a positive way when solar energy development in Morocco is achieved and is mentioned in all policy documents. Solar energy development will help to make Morocco more resilient and help deal with environmental issues to which the country is vulnerable. The NES names the environmental factor in the broadest way possible by stating that solar energy generation positively impacts the environment. This is in line with the MSP and the NDC, which also describes that solar energy can be a solution to

help with issues concerning the environment and climate change. The LAP only addresses the fact that solar energy development can reduce GHG emissions in the country.

Solar energy development can influence the social progress of Morocco. Where the NES ignores the social impact of solar energy, the other policy documents do. The Solar Plan is mainly focused on how the tangible infrastructure for solar development can positively impact fighting against poverty through the accessibility of basic infrastructure and the reduction of costumer's energy bills. The agreement with the NDC is that the social vision of solar energy also states that it will help fight poverty and social inclusion by implementing basic infrastructure. However, the difference is that NDC but also the LAP indicate that social activities such as training, job generation activities and social development projects are positive outcomes of solar energy generation.

As indicated in all the policy documents, the solar future has a positive effect on Morocco's economy. First, both NES and the MSP see solar energy as a way to reduce energy and import costs. In addition, a clearly stated economic aspect of the vision for solar energy is the opening up to the regional and Euro-Mediterranean energy market that goes along with cooperation, energy security, transfer of technology and expertise, and ensures the competitiveness of solar energy generation in Morocco. Another common thread running through the MSP and the LAP is that solar developments create jobs at the local level and other economic activities. The NDC remains close to the vision of solar energy, which focuses on resilience and environmental issues. The economic benefits of solar energy aim at promoting the resilience of the agriculture sector, which is an important sector for the country.

The role of the actor dimension showed that, on the one hand, there is a focus on coordinated expert decision-making. On the other hand, public engagement, informing and public meetings are mentioned. The NES strategy should be supported by the national agencies and a partnership between the public and private sectors who help in managing the solar development with control. Besides, the policy also sees the importance of gaining support from citizens with the help of regular communication campaigns about the objectives the country has for solar development. The MSP, on the other hand, could be more focused on involvement, as the site selection for solar development was focused on a qualified technical approach. The NDC is most focused on involvement. The policy document states that governance will have better coordination between different levels of governance and civil society actors. Public participation and a collaborative approach is an important factors that should take into account the impact on humans from solar development. Also, the LAP shows some involvement. The land is acknowledged as collective, is bought under a

voluntary land acquisition and public meetings are planned. However, like the NES, also LAP also relies on technical and expertise factors. The analysis for the site selection and the risk and benefits for the local community is based on technical criteria.

A thorough description of the findings from the Interpretive Policy Analysis performed in this study is provided in Table 3. The key findings and insights from the examination of several policy documents pertaining to Morocco's solar energy development are summarised in the table below. The table categorises the various STI factors, such as desired future outcomes, technological emphasis, environmental considerations, social implications, economic impacts, governance approaches, views of justice, and level of involvement. Where nothing has been filled in in the table, the vision could not be found in the policy document.

Table 3: Summary Results Interpretive Policy Analysis (Source: Author)

	Desired Future	Technology	Environment	Social	Economic	Governance	Understanding of Fairness	Involvement	Top-down, Authoritarian approach
National Energy Strategy Morocco (NES)	The aim is to guarantee Morocco's energy security, the diversification of the energy sources, making renewable energies the keystone of the national energy policy, and ensure the rational use of energy.	Upgrading the human resources, scientific research on RE and its technologies to successfully implement the strategy based on reliable and competitive technological choices.	Promoting solar energy has an impact on the environment as it limits GHG emissions.	-	Morocco has an important regional role in the energy field with possibilities to facilitate integration into the Euro-Mediterranean energy market. Solar energy will help to decrease the cost of importing fossil fuels. Solar energy can ensure the competitiveness of Morocco's economy. As a critical player in the energy framework of the Euro-Mediterranean energy cooperation, Morocco can economically	The strategy must be supported by implemented institutions.	-	Regular communication campaigns will be organised to mobilise active forces and communicate the objectives of the strategy. A partnership between the public and the private sector is required as well as broad support from citizens.	The development is managed with control and expertise. This public-private partnership-based decision-making tool for the State and sector operators will be established, with competent but fewer staff members and reliance on outsourced knowledge.

					benefit from the cooperation in the energy sector.				
Moroccan Solar Plan (MSP)	The objective is to reduce Morocco's energy dependence, guarantee energy security, and use of alternative energies to diversify the national energy sources.	CSP concentrated solar technology implementation is needed to develop a secure energy sector in the medium and long term. The technology will help to satisfy the need for electricity at the lowest costs possible. Identifying the suitable technologies in the Moroccan context helps to materialise the position of top innovators and champion of green growth in Africa.	The transition to solar energy addresses contemporary environmental and climate change issues. Solar sources and its technology do not produce polluting emissions, therefore helping to fight against the greenhouse effect. The RE pathway with a clean economy includes taking into account the environment.	The energy sector of Morocco has a significant influence on the conditions of social progress. The development of the solar sector contributes to the fight against poverty and the accessibility of basic infrastructure —the reduction of customers' energy bills through solar energy development.	The construction and maintenance of solar infrastructure create permanent and temporary jobs. The long-term contracts bring a stable cash flow and yield attractive. Energy efficiency mitigates the burden of energy costs on the national economy. Energy is essential for any production process and economic and social development. Morocco acts as a hub by integrating	-	The ambition is to make this plan a way to enhance Moroccan human capital and promote local industry.	Qualified human capital is a determining variable for the success of the energy strategy nationally. The choice of development sites is not arbitrary, it is a technical procedure, including fine mapping of the solar resource in Morocco based on criteria such as irradiation, nature of the land, and basic infrastructure.	-

					into the African regional energy system and Euro-Mediterranean to strengthen energy security, lower costs supply chain, expand exchanges, develop cooperation, transfers of technology and solidarity.				
Moroccan Updated Nationally Determined Contribution (NDC)	Envisions the resilience of civilisation and the country to climate change while ensuring a rapid transition to a low-carbon economy by decreasing GHG emissions and solar development.	Technology and the mobilisation of innovative solutions for effective adaptation action are required to build resilience to climate change.	Adaptation is a priority for Morocco, given its high vulnerability to the impacts of climate change. The power generation and the industry sector have the potential to help the decarbonisation of the Moroccan Economy.	The policy aims to fight against poverty and social exclusion through the implementation of basic infrastructure, training, social projects and income and job-generating activities.	RE energies and less GHG emission promote agricultural land's resilience and the most vulnerable economic sector to climate change in the Moroccan economy.	Governance and strategic management should be optimised by better coordination with the levels of territorial governance and civil society actors.	-	Improved interaction between the Moroccan State, the private sector, and international financial institutions is needed. National institutional arrangements, public participation and engagement with local communities and indigenous peoples are important.	Supporting policymakers and stakeholders at all levels to develop and implement in a collaborative and coordinated approach, coherent and effective policies and measures, placing humans at the centre of concerns, in order to adapt and increase the resilience of natural, social and economic systems in the

								Improving access to climate data information and knowledge from scientific research will inform decision-making.	face of the impacts of climate change". So no top-down approach per se.
Land Acquisition Plan (LAP)	To free itself from dependence on fossil fuels, the Kingdom of Morocco is implementing a large-scale strategy to increase the production of renewable energies.	Investment in solar energy technology is needed to address energy import dependency.	The implementation of solar infrastructure will help to reduce GHG emissions.	The proceeds of the community territory sale where solar development is placed will be put in a special fund for financing social development plans for the local community.	The project has positive impacts on the local populations in terms of jobs and induced local economic activities.	A trusteeship council of the collective land is responsible for analysing the risks and losses and the benefits for the community.	It is recognised that the land by its nature is collective land.	Public information meetings were organised to inform, present and answer questions and concerns about the project.	The land acquisition is voluntary. The site selection is based on geographical and technical criteria.

4.4 Document Analysis

This sections delve deeper into expert visions in various document types. News articles, reports and opinion pieces are included to understand the STI of experts on Morocco’s solar energy journey. There will be a discussion of the various STIs and their similarities, and a summary of the results is included in Tables 4,5 and 6.

4.4.1 Expert’s Visions in the News

The importance of solar energy is envisioned as positive by the expert visions in the news articles. Where some experts and agencies, such as the Kingdom of Morocco, MASEN, private investor groups, economists, manager climate investment funds and the World Bank, argue that solar energy will help with energy security, the growing energy needs, and power millions of Moroccan households, other expert views focus on economic growth, conservation of the environment and reduction of GHG emission, and the exemplary function of Morocco.

Multiple national agency experts highlight the economic benefits of solar energy development, including job creation and attracting investments. They highlight Morocco's potential to emerge as a leader in RE and an exporter of clean energy to Europe, which may support economic expansion and strengthen partnerships with other nations. The implementation of solar megaprojects in the Sahara will enable the exportation of excess solar electricity to Europe, according to Morocco's environment and national energy ministers. The bulk of expert visions for these solar power development implementations place a strong emphasis on money and financial support. While some articles highlight the financial advantages of solar energy development, such as job creation and economic growth, others highlight that local residents might not necessarily recognise or directly benefit from these financial advantages and solar development.

Many visions incorporate a positive impact on the economy and development through solar energy development. However, the AMEE and local and expert organisations and the manager climate investment funds also believe that solar development has good effects on combating climate change and reducing carbon emissions. Solar energy is portrayed as a cleaner and more sustainable alternative to fossil fuels, aligning with Morocco's commitment to environmental conservation.

The expert visions in the news articles emphasise Morocco's ability to lead by example in the adoption of RE sources and to contribute to the growth of the larger African energy landscape. Different experts have different ideas on how to accomplish this. However, this vision is generally shared, which means that cross-border cooperation, professional training,

seminars, and financial backing from international financial institutions are all vital in the implementation of projects. Furthermore, it is made clear that political stability and government leadership play a key role in luring investors and creating a favourable climate in Morocco for the growth of solar energy and electricity exports.

Different viewpoints on the socioeconomic effects of solar energy development are presented by the visions. Even though most are aware of the potential for job creation and economic growth, some raise concerns about ensuring that nearby communities gain the most from these initiatives. Several articles discuss the necessity of training and capacity-building initiatives to provide qualified human resources for the solar energy industry. They understand the importance of giving the next generation the information and abilities they need to contribute to the sector.

4.4.2 Expert's Vision in Reports

Similar to the news articles, the reports show the positive STIs of solar energy development in Morocco. STI that come forward in the reports include: RE as a driver for socio-economic development, positive effects for the local area in terms of job provision, economic benefits, competitive advantages, improved living standards, and access to infrastructure and energy; the attraction of private investors; the mitigation of (local) environmental impacts; and will help satisfying energy demand.

First, Morocco's socio-economic development can occur at two levels, namely the national level and the local level, as expressed in the reports. In addition, the reports resonate with the idea that solar energy is not solely about power generation but also a catalyst for broader socio-economic advancement. The energy sector can help the Moroccan economy become a competitive player in the global energy market (MASEN, 2017). Likewise, the San Giorgio Group (2012) points out the economic benefits and potential for private sector engagement in solar technology. Solar energy infrastructure can help Morocco to become competitive and enjoy economic benefits on the national level. However, also the local level can enjoy the benefits of the desired solar visions, as described in all reports. In most of the reports, this socio-economic development mainly takes the form of economic benefits. While the San Giorgio Group report (2012) points out the local economic benefits by naming the opportunities of local manufacturing industries, MASEN (2012) also highlights that solar energy will help develop competitive advantages and economic benefits for the local communities. MASEN (2017) and the World Bank Independent Evaluation Group (2021) describe that solar energy development has a positive social impact, as it offers opportunities for job creation, the improvement of accessibility to basic infrastructure, and the improvement of local living standards.

Beyond economics, the reports highlight the environmental aspects of solar energy projects. The experts emphasise the potential to mitigate environmental impacts and reduce carbon footprints through clean energy adoption (MASEN, 2017; MASEN, 2012; World Bank: Independent Evaluation Group, 2021), which will have positive consequences, both at national level and local level.

The way this vision can be realised is mainly focused on financial support from public-private partnerships and international funding institutions and technical support from energy professionals. In addition, MASEN (2012) points out that public consultation and a legal framework to govern environmental protection of development is a way to implement the solar vision.

4.4.3 Expert's Visions in Opinion Pieces

The expert visions in the news articles and the reports include the positive impacts of solar energy development for the socio-economic development of the country and the local community and the positive impact on the environment. However, the expert visions in the opinion pieces also show the reality of the desired solar future on the local community.

The experts point out that energy transitions are shown as a progressive and with a techno-optimistic viewpoint (The Middle East Research and Information Project, 2020). There is little room for the social and equality aspects of solar development. In addition, promises within the STIs regarding solar energy development are not being realised. Although there are attempts at local social development by MASEN's fund, this statement is debunked by "Life in the Vicinity of Morocco's Noor solar energy project", which states that promises of economic benefits, job provision and improvement of local social life are not with. Furthermore, where news and reports show that raising awareness among the local and public consultation is part of how the STI can be achieved, the expert vision in the opinion pieces raises issues with democratic procedure, openness, and political participation while criticising Morocco's centralised administration or RE projects. Furthermore, the local population are frequently excluded from decision-making, as they were never informed (Research-activist, 2018). There is a focus on centralised authority, no transparency and no political participation for the local community (The Middle East Research and Information Project, 2020). The centralised and non-inclusive process of implementing the solar vision influences the daily local STI of solar energy. Another social implication of solar development is the concern over the privatisation and monetising of nature, as mentioned in "The Ouarzazate Solar Plant in Morocco: Triumphal 'Green' Capitalism and the Privatisation of Nature", "Life in the Vicinity of Morocco's Noor Solar energy project ", and "Global

aspirations and local realities of solar energy in Morocco". The experts also express concern about the privatisation and monetisation of nature for the benefit of a small group of elites. They stress the necessity of solar energy projects to address concerns of equity and inclusion as well as to provide economic benefits for neighbouring communities. Additionally, the effects of land acquisition on nearby populations are emphasised, particularly in terms of diminished access to communal pastures and modifications to the agricultural environment.

The results of the document analysis are shown in the tables below. The tables present a comprehensive overview of the key insights from the news articles, reports and opinion pieces. The various documents highlight diverse viewpoints from different stakeholders and show the complexities and concerns regarding STI of solar energy development in Morocco.

Table 4: Document Analysis Result Summary: News Articles (Source: Author)

News	What	Who	Where	When	How
Saïd Mouline, CEO Moroccan Agency for Energy Efficiency Interview	Morocco should prioritise solar energy and energy efficiency so that the country can reduce GHG rapidly, have lower energy costs and provision of new jobs can be created in the energy sector and other sectors.	Moroccan Agency for Energy Efficiency	National and Regional	2020	Political will of the highest level of the state. Green financing and national financial support for energy efficiency will help to make quicker progress, even as voluntary policy regarding energy efficiency in all sectors. Capacity building and raising awareness mainly under young people by training them to be a part of small projects.
National Energy Strategy	Solar energy will help to respond to the increasing demand for electricity, gain energy security, and reduce energy dependence. Morocco can become a role model at the regional and continental levels as solar energy will provide economic, social and environmental conditions that ensure a good life for citizens.	Kingdom of Morocco	National	2021	By implementing many programs and projects to produce clean energy resources. Adopting objectives for diversifying energy supply sources.
Noor Ouarzazate: Inauguration of a thermal storage system	Cope with the needs of Morocco and Africa, as Morocco desires to contribute to the development of Africa.	Moroccan Agency for Sustainable Energy	National	2020	Developing solar projects with foreign help or cross-border cooperation and providing training.
Renewable energies: MASEN keeps its targets for 2030	RE makes it possible to supply 1.1 million homes with clean energy Morocco is followed by the commitment to clean energy by operators and media worldwide, so	Moroccan Agency for Sustainable Energy, ACWA Group	National	2017	Workshops bring together energy professionals and industries that operate (in)directly in the renewable sector to envision lines of cooperation between the participants.

	Morocco is gaining an exemplary role and helping to attract projects and investments.				
Morocco's clean power revolution	RE helps fight climate change, fulfil growing energy needs, boost Morocco's energy independence and economic benefits, causes global attention, and is a source of pride. However, many Moroccans do not see the economic rewards of a greener Morocco.	Locals and expert organisations	National and Local	2017	A network of public and private solar, wind and water projects with the financial help of the World Bank and other international institutions to build infrastructure. Besides, the Kingdom of Morocco spends more than seven million on local development around the energy production site.
Solar Sahara	Solar energy can provide cheap RE for Morocco and private investors. As a RE superpower the government hopes renewables will help to transform their country's fortune and boost cooperation with Europe.	Morocco's Energy Minister	National	2023	Exploiting the potential of Europe as an expected major export market, therefore offering RE to export as it is also important for attracting private investors, and investigating electricity interconnections.
Solar superpower- Focus: Taking the lead in renewables,	Greater control of energy costs and energy security, and paying attention to the conservation of the environment. There is potential to export the excess power to Europe and become an example for other countries.	The Business I year	National	2020	Targets can be met by implementing colossal megaprojects in combination with policies that favour renewables.
Morocco seeks energy salvation in sunshine, wind- Govt launches solar plan with Ouarzazate contract	RE investment will change Morocco from an energy-poor country to an exporter and boost the economy.	Economist at the National Institute of Statistics and Applied Economics Morocco	National and International	2013	Financing for promoting solar energy by bids of developers and loans from the African Development Bank.

Sun harvested for energy	RE provides millions of Moroccans with power and reduces carbon emissions.	Manager Climate Investment Funds	National and International	2016	Morocco's political stability, the government's leadership role, the creation of a solar energy agency and phasing out fossil fuel subsidies are suitable for attracting financial support.
Solar plant pride of Morocco	Solar project is a showcase internationally as it will be able to power a city of two million and boost economic growth while seeking greener energies.	Head MASEN	National and Local	2016	Funding of the European Union and attracting investors while providing political stability, a predictable legal and banking system.
Moroccan solar plant to bring energy to million people	Morocco can become a renewable powerhouse as there is huge potential for solar energy, play a part in the energy revolution and can export power into Europe	Environment Ministers and King	National and International	2015	Turning the previous useless slice of Sahara will be used for a giant solar power plant. Furthermore, we do not have to do anything since Europe starts to need the energy.
A brighter future for Morocco's interior powered by the sun	Solar energy will help with a more reliable supply of power and will bring significant benefits to the local population and economic development.	World Bank Energy Specialist	National and Local	2015	A World Bank supported project will harness the sunshine in the region, turning it into energy

Table 5: Document Analysis Result Summary: Reports (Source: Author)

Reports	What	Who	Where	When	How
MASEN Press File: MASEN endless power for progress	Solar energy helps meet the increasing energy demand whilst fighting climate change. Internationally Morocco can provide a competitive solar energy sector and can be a preferred partner for any country that wishes to make RE a priority for socioeconomic development.	Moroccan Agency for Sustainable Energy	National	2017	Raising the necessary funds for projects, ensuring a competitive energy sector by public-private partnerships, to maximise MASEN's negotiation power with various stakeholders.

	Solar energy projects are also part of its local area as they can create jobs for locals in the construction and operation and maintenance phases.				
Summary of the Environmental and Social Impact Assessment	Solar energy projects have a positive impact on the project area and the local communities: it will develop competitive advantage, and economic benefits, reduce energy dependence and GHG emissions.	Moroccan Agency for Sustainable Energy	National and local	2012	A legal framework should help govern environmental protection and development, public consultation and should create prospects for individuals and corporations from the public and private sectors.
MA-Ouarzazate Concentrated Solar Power-Implementation Completion Report Review	Solar power mitigate GHG emissions and local environmental impact. The neighbouring communities can expect a strong positive social development impact such as stimulating the local economy, improved living standards, improved connectivity with road access and created jobs.	World Bank: Independent Evaluation Group	Local and international level	2021	Financing with a public-private partnership. Financial support for the giant CSP plant from the World Bank and the African Development Bank and Kreditanstalt Fur Wiederaufbau. The community projects are financed through a project designed development fund.
San Giorgio Group Case Study: Ouarzazate I CSP	CSP technology has enormous potential as a reliable source of RE and fosters economic benefits such as local manufacturing industries, improved energy security and a shift away from fossil fuels, and could attract and increase private sector backing.	Advisory organisation	National	2012	International support, financial and technical contribution is needed. A favourable regulatory and renewable policy framework to encourage private sector engagement. A public-private partnership model for optimal alignment of risks between public and private players.

Table 6: Document Analysis Result Summary: Opinion Pieces (Source: Author)

Opinion Pieces	What	Who	Where	When	How
Global aspirations and local realities of solar energy in Morocco	The solar project will increase Morocco's visibility worldwide but locals have never actually seen the installation. Solar plans form a part of the state's effort to territoriality its presence in the rural hinterlands.	The Middle East Research and Information Project	Local	2020	In Morocco, RE also feeds rural political opposition and claims for equity, transparency and political participation, as discussion is only focused on how particular communities development projects are implemented. In the context of nearly two decades of decentralisation reforms in Morocco aimed

	There is a struggle between the techno-optimism of the regime and the social mobilisation of residents that show the social and economic inequalities, challenging assumptions that a low-carbon energy transition is inherently progressive. The focus on global trade networks of the projects exacerbates the level of inequality while benefiting the elites tied to the palace.				at regionalising governance and fiscal policy, the emphasis on centralised authority over RE highlights the strategic importance of the sector. Therefore the low commitment of the government to democratic practice and the marginalisation ensures for problems.
The Ouarzazate solar plant in Morocco: Triumphal 'Green' capitalism and the privatisation of nature	Solar energy generation will help to shift from fossil fuels to RE still capitalism remains with commodifying and privatising nature for the profits of the few. The CSP project will be used as a flagship project to enhance its international standing by attracting more political and strategic rents at the expense of democratic change and the inclusion of the resident's opinions about the land.	Research-activist	Local	2016	People mobilised around long-standing grievances about water, land and the right to benefits from economically profitable projects. However, the existence of laws with colonial origin that have functioned to concentrate collective land ownership within the hands of an individual land representative, who tends to be under the influence of powerful regional nobles. Residents of the surrounding communities were never informed of the process of site selection and the terms of the sale has no mandated procedure for consulting with them
Morocco: Ensuring a large-scale renewable installation benefits local communities	Solar energy should result in economic benefits for the adjacent communities, a feeling of pride, and job provision. However, residents near the plant had their concerns, information provided lacked, and insufficient consideration of local context during project outreach and engagement.	World Bank	National and local	2021	Social Development Plan to improve infrastructure and services, a local content target to ensure local employment and business opportunities and community engagement efforts through training and education.
Life in the Vicinity of Morocco's Noor solar energy project	Solar energy led to land acquisition and loss of access to collective pasture for villagers. Solar energy promised global visibility, infrastructure, and reshape life in	Associate professor departments of sociology and of women's, gender and sexuality studies	Local and national	2017	The valuation of the land was low because MASEN's narratives about the area revolve around notions of "emptiness, aridity and waste".

	rural communities through economic rationalities. However these promises and reducing the perceived gap between the mega-futurist project and the surrounding population have not been realised and there is marginalisation and injustice.				Local development was made possible by MASEN's budget to improve access or open up a region.

4.5 Summary of the Findings

The analysis of Morocco's solar energy development through various document formats, including policy documents, news articles, reports, and opinion pieces, reveals common goals and conflictual viewpoints that shape the vision of the nation's solar future.

A cohesive vision of Morocco's future solar energy takes shape within policy documents. The potential transformative power of solar energy is highlighted by the NES, Moroccan MSP, NDC, and LAP. The employment of technology is crucial for creating a future powered by solar energy, as stated in all policy documents. Solar energy development positively affects societal well-being, (local) economic prosperity, job provision, regional cooperation and integration into the energy market, and environmental resilience. On the one hand, there is a managed, technical, and expert-focused decision-making process. On the other hand, it is acknowledged that public engagement, participation, and information are crucial to gaining support for installing solar infrastructure.

The document analysis shows that RE plays a huge role in obtaining economic development, a better social life and environmental conditions, as is stated in the reports and the news articles. This STI is similar to that of the Moroccan solar energy policy documents. In addition, MASEN (2012; 2020) points out that raising awareness about the projects and public consultation is a part of how the vision could be implemented.

While the reports and most news articles and the positive implication of solar energy, there are differences in STIs of solar energy development and somewhat recognise the importance of public consultation, the STIs introduce a layer of nuance in the opinion pieces. The expert visions in the opinion pieces focus on issues with local engagement, socio-economic equality, acquiring land, and the nature of privatisation and monetisation. Besides, the opinion pieces point out the techno-optimistic way in which energy transitions are shown, which is in line with the policies, reports and news articles. However, the difference is that the opinion pieces show that the promises related to the progressive STI of solar energy their promises of economic benefits, job provision and better social life on the local level, cannot be met. Therefore, the findings show that energy transitions are complex issues and unfold different STIs of solar energy development of various stakeholders. This shows the tensions between differences in STIs and the real-world implications.

5. Discussion: Unraveling Socio-Technical Imaginaries: Implications for Solar Energy Development

Chapter 5 provides discussions based on research findings from data collected on policy and expert STIs. This chapter will review the literature review and findings of the study. The results show that the STIs of solar energy mainly focus on social and economic growth. However, there are differences in STIs regarding solar energy. This positive and progressive vision of solar energy development it raises concerns about social and economic inequalities, the privatisation of nature, and the need for democratic practices and local engagement. The opinion pieces emphasised the importance of addressing social injustices, involving local communities in decision-making processes, and considering the rights of residents and the environment. Therefore this chapter will focus on the following three findings, namely transitions are seen as technical and progressive, which include social and economic development, STIs are not universally shared, and energy infrastructure envisioned has real-world implications

5.1 Energy Transition Envisioned as Techno-Optimistic and Progressive Accompanied by Social and Economic Development

As mentioned in one of the opinion pieces, the low-carbon energy transition is accompanied by techno-optimism and thoughts of progression (The Middle East Research and Information Project, 2020). This focus on the value of technology, in the form of energy infrastructure, for realising Morocco's solar energy future is highly valued in the policy documents. The focus on the implementation of technical megaprojects also shows that the technology is important for the realisation of a solar energy future as described in several documents (Environment Ministers and King, 2015; The Business I year, 2020b; World Bank: Independent Evaluation Group, 2021). As other researches indicate, energy infrastructure is outweighing its technological potential for transmitting, transforming, or storing energy (Shove and Walker, 2007; Geels 2011). It also incorporates the social, political and economic dimensions of the impact of energy infrastructure (Bridge et al., 2018). This is highlighted in Moroccan policy and in the documents. In addition to focusing on technology, the policy documents focus on the social and economic benefits of solar energy development. These social and economic benefits are shown as the ingredients for the country's progression. In the policy documents, this is expressed in visions such as Morocco becoming a key energy player and can open up to regional and international energy markets (MSP, NES), the creation of jobs (MSP) and induced local economic activities (LAP) for the economic benefits. In addition, the social dimension is described in some policies as solar energy development has benefits for social progress, it contributes to the fight against poverty and social inclusion, will give access to basic infrastructure in the arid areas where solar infrastructure is implemented (MSP, NDC) ,

and the realisation of social development projects and training (NDC). The majority of the news articles and all reports align with these visions of solar energy bringing socio-economic development, both at the national level and locally. Where Ha and Byrne (2019) state that visions of sustainable development mainly rely on technological solutions while downplaying the justice and social implications, the policy papers, reports, and news articles show that the social implications are also envisioned. However, the statement of Ha and Byrne (2019) is still applicable in this research, as will be elaborated on in section 5.3, as the real-world STIs of solar development are more nuanced than the progressive STIs mentioned in policy, news, and reports.

As described above, theory shows that in modern energy systems, the social, economic and technical visions dominate the system for making policy decisions and the process of policy-making (Lee and Byrne, 2019). What differs between this theory and the results is that where much attention is paid to socio-economic benefits, there is also a focus on the impact on the environment. The policy and the news articles and report point out that solar development will help in mitigating environmental issues and helps with becoming more resilient. It is true that the focus on the economy is greatest, followed by the social benefits of solar energy development in Morocco. Returning to Lee and Byrne (2019), the focus on the social, economic and environmental gains is central to how the decision-making process is persuading society that there is no other option only to support solar energy development as it brings progress. This statement can be supported by the findings of this research. The positive impacts on the local community, the economy and the environmental challenges are treated excessively in the policy and the experts' visions in the news and reports. Visions such as solar energy are providing a better life for Moroccan citizens (Kingdom of Morocco, 2021), it will help with fighting poverty and social exclusion (MSP, NDC), job provision (MASEN, 2012; 2017), social development plans for the local community will be set up (LAP), and economic rewards and local economic development will be fueled (Economist at the National Institute of Statistics and Applied Economics Morocco, 2013; World Bank Specialist, 2015), fit well with the theory of Lee and Byrne (2019). However, a dissenting opinion is dealt with in the opinion reports that are dealt with in section 5.3.

Besides, the process for successfully implementing the solar STIs is envisioned on the one side as controlled and led by expertise, but also there is the necessity to include the public or as in documents it is described as it needs financial and technical support (MASEN, 2020; MASEN, 2017 and ACWA Group, 2017; Head MASEN, 2016; World Bank: Independent Evaluation Group, 2016) and raising awareness and consult the public (MASEN, 2020; 2012). Therefore it aligns with theory as it focuses on the use of technology and the controlled way of decision-making. An example is the siting process that is characterised by

taking into account only the technical selection criteria and not taking into account the social, cultural and historical characteristics of the area, as mentioned in opinion pieces. Besides, the Environmental and Social Impact Assessment (MASEN, 2012) points out that no social or environmental conflicts are involved in implementing large-scale solar infrastructure (Lee and Byrne, 2019). The results differ from the theory as it is described that the implementation of large-scale technology is envisioned as involving social conflicts, which is mentioned in the opinion pieces.

This section (5.1) outlined the techno-optimistic and forward-thinking perspective of Morocco's transition to solar energy, emphasising its alignment with policy goals and expert visions. This shared vision, however, contrasts with the various and contentious STIs examined in the following section. These STIs show differences in perceptions and expectations on the growth of solar energy.

5.2 Socio-Technical Imaginaries are Contested

The findings showed that the policy documents, the news and the reports show alignments regarding the STIs of a Moroccan solar future. One reason for this alignment is that most of the news articles and reports show STIs from experts within energy institutions set up by the Moroccan government or have a stake in the financial part of the Norwegian project. This shows that the role of the stakeholder can influence the leading STIs and its outcomes.

This also means that different stakeholders can have different STIs of solar development. The findings showed that the STIs of solar energy in Morocco are not all the same. STIs are contested as there is a difference in understanding of solar development (Levidow and Raman, 2020). The misunderstanding is expressed in various STIs in policy and document and the real-life implications described in the opinion pieces. This mismatch between STIs is shown in this research by a number of factors. First, there are different expactations and interests of solar energy (Döring et al., 2018). In addition, the distribution of the benefits and burdens of solar energy influences solar STIs (Devine-Wright, 2005). In “Morocco's clean power revolution”, it is stated for example, that many Moroccans do not see the economic rewards of energy transition. The expert vision in the Middle East Research and Information Project (2020) shows that there is an unequal distribution of benefits between the locals and elites this affects, according to Devine-Wright (2005), how well the STIs are received by the locals and is expressed in the opinion pieces as opposing voices. Furthermore, the valuing of land causes conflicts in the STIs. According to Koch (2021), the desert is seen as being empty, or as the Environment Minister and King (2015) describe the vision of the useless Sahara will generate economic and social development by the use of a giant solar power plant. This valuation of the land can impact the differences in solar energy STIs, as the

valuation was too low, and promises are not realised within the context of the Sahara, as mentioned in the opinion pieces. These factors are mentioned in the opinion pieces and show the opposite of the techno-optimistic and progressive STIs stated by policy and energy experts in government institutions and stakeholders.

As this section shows that STIs can be contested and are not universally shared the next section will address the real-world impacts of STIs.

5.3 Energy Infrastructure has an Impact on the Real-World Experience

This section addresses that STIs have real-world implications for policy formation, implementation of the vision and public participation.

Theory suggests that there are implications to energy transitions when not keeping in mind the social and justice implications (Moore, 2017), it can result in misunderstanding of visions and opposed STIs, as discussed in section 5.2. Whereas the policy, reports and news build their STIs of solar development in Morocco around promises of a better social and environmental life and economic development, the expert visions in the opinion pieces that include the local community's visions of solar development show the real-world implications of these STIs. A conflict of solar visions can be seen between solar energy as a priority for socio-economic development and the positive effects on the local community in Ouarzazate in terms of job provision, increased local economic activities, and the improvement of the living standards using of available infrastructure versus the promises of better social and economic conditions are not met, and many Moroccans do not receive the economic rewards. The findings indicate that energy infrastructure have impact on unequal socioeconomic outcomes (Bridge et al., 2018). This is the opposite of the argument of Lee and Byrne (2019) who state that the focus on implementing technology is not accompanied by social or environmental conflicts. Besides the different visions of solar energy development, people mobilised as there is a long-standing grievance about land, water and the right to benefit from solar energy projects.

STIs can influence the policy to increase public support and how the decision-making process is designed (Echevarria et al., 2022). The findings show again a discussion between policy (government) energy experts and the opinion piece author, who are representatives of the local community of Ouarzazate. Envisioned as a controlled and expertise-led implementation of the solar vision with room for public information and consultation, the country's authoritarian character has caused a difference between the vision in policy and how it is implemented. The findings indicate that instead of public consultation, there is no

engagement, no consulting or information provision. In line with theory, decision-making in Morocco's energy transition is power-ridden, which raises concerns regarding justice implications (Lawhon and Murphhy, 2012). This is expressed in the opinion pieces by demonstrating that residents near the plant were concerned and were not remedied because there was no information provision, the local culture and social life was not taken into account, and there was no commitment of the government to include public participation and consultation. The centralised process can be traced back to the strategic importance of the energy sector, which offers progress for Morocco, which is why there was little commitment to democratic practices. In addition, the document analysis indicates that even though there has been decentralisation of Morocco's state power since the 1980s, the Moroccan public authorities, in particular King Mohammed VI and his advisors, remain central actors in economic and social policies (Catusse,2009) and therefore these findings show that energy infrastructure sustains political and economic power (Collier, 2011; Bridge et al., 2018). Furthermore, this fits well with the argument of Sim and Mills (2021), that point out that in the Global South, a centralised approach to implementing large-scale energy projects is the preferred way to operate. Recognising these dynamics is essential for understanding opportunities for and hurdles to the solar energy sector development (Vidican, 2015), as the findings show how the STIs of solar energy in government policy and by energy experts affect how solar development is received by the local community in Ouarzazate who experience the impacts.

The opinion pieces emphasised the importance of addressing social injustices, involving local communities in decision-making processes, and considering the rights of residents and the environment. Energy transitions are complex issues that are subject to various interests (Döring et al., 2018). In policy and envisioned STIs by energy experts, solar energy development can provide a sunny future with socioeconomic and environmental progress. However, when the social and justice implication of the implementation of solar projects are not considered, STIs can fail to engage with the way in which local communities envision their energy future.

6. Conclusion: Navigating Visions and Realities

In this chapter, an answer to the main research question is presented. The implications of the findings for planning practice are further discussed in this chapter. The answers to the research sub-questions and accompanying discussion presented in the previous chapters have provided the information to answer the main research question and elaborate upon the implications.

6.1 Answering the Research Question

This research aimed to explore whether there are conflicts or alignments between the STIs for solar development in Ouarzazate envisioned by various experts and policies and the implementation of these visions by conducting an interpretive policy analysis and a document analysis. Therefore the following research question was formulated: “How do the STIs on solar development differ between those provided in the national energy policy and the visions of the energy experts in Morocco?” By investing the STIs in policy and the expert visions, conclusions can be drawn related to the main research query.

The policy emphasises the role of technology and innovation in realising the desired solar energy future. The use of solar technology is envisioned as a driver of economic development, social advancement, and environmental benefits. The emphasis is on a controlled and expertise-led approach on the one side. However, in policy, it is also mentioned that public engagement and information provision are necessary for the acceptance of Morocco's envisioned solar future.

Similarly, the energy experts' visions working for the government energy institutions or are financial stakeholders show that RE plays a huge role in obtaining economic development, a better social life and better environmental conditions. However, the opinion pieces included in this research point out that there are different STIs regarding solar energy development and that STIs can have real-world implications. The expert visions of solar development in Ouarzazate in the opinion pieces include concerns about the social and economic inequalities and the unequal distribution of economic rewards of the project, raise issues with democratic practices and local engagement of solar development, and the privatisation and monetisation of nature. The opinion pieces emphasised the importance of addressing social injustices, involving local communities in decision-making processes, and considering the rights of residents and the environment in the STIs of solar development in Morocco, as policy can neglect the practical and ethical dimensions of project implementation.

The analysis of Morocco's solar energy development through various document formats, including policy documents, news articles, reports, and opinion pieces, reveals common goals and conflictual viewpoints that shape the vision of solar development in Ouarzazate.
There is a collective imaginary between policy and experts that are related to one of the created energy institutions and financial stakeholders and follow the progressive energy agenda. The policy emphasises techno-optimism, economic growth, and environmental benefits, framing solar energy as a catalyst for progress. However, expert imaginaries reflect a more nuanced perspective. The expert visions point out a mismatch between STIs in policy and the lived experience of local communities and their, therefore, different STIs of solar development in Ouarzazate. Where the policy promised social, economic and environmental improvement, these visions do not engage with the way the local community envision their solar future as promises of social, economic and environmental progress are not seen by the local, there is no sign of public consultation, inequality in the distribution of benefits and disadvantages, and the local cultural and social context and marginalisation history was not taken into account. This difference in STIs shows that when the socio-cultural context in which the project is embedded is not taken into account STIs can have implications on implementation outcomes as the vision can be accepted or opposed.

Overall, the findings indicate that there is a desired vision of solar development in Morocco, incorporating environmental, economic, and social aspects, including a centralised and public consultation approach between policy and energy institution experts or financial institutions. But there are also conflicts and challenges that need to be addressed. The outcomes have social and justice implications. Therefore, the expert and local visions point out the failure of social and economic development in Ouarzazate and the inequality in the process of implementation.

6.2 Implications for Planning Practice

The case study and theory underscore that energy transitions are complex issues of social change that unfolds on all levels of society and are subjected to various interests and objectives (Döring et al., 2018) and there are challenges of translation and implementing STIs into reality. In order to contribute to energy transitions, policymakers should consider these various viewpoints. Policymakers can learn from these issues around conflicting visions. By considering these diverse viewpoints, policymakers and stakeholders can navigate the complex terrain of solar energy development while ensuring that the transition to cleaner energy is both equitable and sustainable. What is important here is a better process of forming STIs that align with different stakeholder, including the visions of the local community. Besides, the mismatch between promises made in policy documents and the lived experiences of local communities highlights the significance of effective governance

and transparent decision-making, which could better focus on more inclusive consultation and transparency. What is even more important in the process of implementing STIs of solar energy is that an in-depth understanding of the social and cultural context in which the project is embedded is worth considering, as the case study showed that there is a weaker understanding of the cultural, social, and political dimensions in contrast to that of the economic and technical dimensions.

Finally, the findings of this research present that energy transitions are more than just a replacement of a technology with another one, it involves social, economic and environmental dimension that are impacted by STIs of energy transitions. Where STIs can align, they can also be contested, as STIs have real-world implications.
Therefore it is important for policymakers to bear in mind the social and justice implications of solar energy development in the process of forming STIs and the implementation of visions of solar energy.

7. Reflection on Research

7.1 Strengths and Limitations of the Research in Relation to the Validity

One limitation of the chosen research methodology is the lack of direct access to research subjects due to the politically sensitive nature of the case study and the topic. This constraint hindered the ability to conduct interviews, which could have provided deeper insights into expert perspectives and STIs. Relying solely on document analysis might limit the breadth of perspectives and the depth of understanding that could be obtained through direct interactions with stakeholders. Besides the authoritarian background in Morocco could have influenced that negative or critical news or report are hardly found, which could have influenced the outcome of the findings. However, since it is a high-profile project it got attention and there were a lot of publicly available data, reports and documents available. The documents still give a comprehensive picture and there is a chance that the energy experts who work for government-established institutions will describe in an interview a similar vision in the self-developed agenda or the agenda within which they work.

7.2 Recommendations for Future Research

This research has provided a preliminary understanding of how policy and expert visions and the implemented outcome of this vision do not align when social and justice implications for the real world are not taken seriously, that leads to conflictual STIs. This research recommends to take into account the social and justice implications of energy transitions. Further research would involve investigating how this incorporation can practically occur within decision-making processes and the development of STIs. It would be interesting to

examine how policy changes driven by the incorporation of social and justice implications fare in terms of successful project implementation. Are they more aligned with local needs? Do they result in better outcomes? An important influences that can also be investigated is the power dynamics. The incorporation of the social and justice implications in relation to the context of energy transitions in the Global South involving power dynamics is an interesting case to investigate how these power dynamics, social and justice implications go together in practical decision-making towards alignments in STIs of solar energy between various stakeholders.

7.3 Reflection on personal process

In this last section of this thesis, the research process is reviewed from a personal point of view. The progress can be described as accompanied by ups and downs. The document analysis was challenging from time to time as I did not want to let my own preconception influence the interpretation of the data, since Moroccan family members could influence by telling their conceptions of the issues in Morocco. Besides, they could also help to find the right translations and search terms or give more background information about Morocco. The data-gathering process did not start in a great manner in the beginning either. The plan was to conduct interviews. However, when contacting a researcher in the field of environmental justice she warned me for the difficulties in getting contact with energy experts in Morocco because of a political tense situation around the Noor Ouarzazate project. After mailing many experts I got a positive reply which gave me some kind of hope. The interview was planned and I saw it as an opportunity to get in in different energy institutions. Unfortunately, on the day of the interview, the expert did not show up on Zoom. In the process, I suggest I waited too long in the hope of conducting interviews. Fortunately, my supervisor eventually helped me to follow this switch in research method. Finding the right policy documents had been a search because on certain governmental websites were already removed. In contrast, I did not want to make mistakes in interpreting the policy and analysing the documents I did enjoy investigating the documents and gave a comprehensive insight into the solar energy situation in Morocco. In addition, I am proud that I dared to choose an issue outside of my own country and culture. All in all, writing the thesis was a constantly changing and iterative but very enjoyable process and increased my interest in fair energy transition.

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