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# Climate Change & Renewable Energy Targets

What Role Does Target Setting Play in National Energy Transitions?

Bachelor's Thesis in Global Systems Engineering

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## Abstract

In light of ongoing climate change, low-carbon energy transitions are a crucial strategy to mitigate further environmental consequences and foster more sustainable societies. Under the Paris Agreement, target setting serves as a primary policy instrument to initiate and accelerate these transitions, yet its effectiveness remains debated in the academic literature. Against this backdrop, this study analysed how target setting in developing renewable energy technologies and their performance have evolved in 18 countries, including both developed and developing, since 1990. The study shows that developed and rapidly developing countries demonstrate different levels of performance in achieving their renewable energy targets. While rapidly developing countries continuously increase their performance, developed countries' performance appears to have stagnated over time. Moreover, there seems to have been a shift in target setting and its performance after the Paris Agreement in 2015. More countries, especially rapidly developing ones, started setting targets and the performance rate became more evenly distributed across most countries. The study also shows that targets for all renewable energy sources tend to be more precisely achieved, while technology specific targets often are significantly overachieved or underachieved. The findings of the thesis fill some of the previously mentioned knowledge gaps, open new questions for further research as well as provide a better understanding of the role that target setting plays in national energy transitions.

Keywords: climate change, energy transition, renewables, targets, comparative analysis.



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# Abbreviations

Below is the list of abbreviations that have been used throughout this thesis listed in alphabetical order:

ASEAN	Association of Southeast Asian Nations
CSP	Concentrated Solar Power
EEA	European Economic Area
EU	European Union
GDP	Gross Domestic Product
IRENA	International Renewable Energy Agency
NDC	Nationally Determined Contributions
NECP	National Energy and Climate Plan
NREAP	National Renewable Energy Action Plan
OECD	The Organisation of Economic Cooperation and Development
REN21	Renewable Energy Policy Network for the 21st Century
RES	Renewable Energy Sources
RES-E	Renewable Energy Sources in the electricity sector
RES (excl. hydro)	Renewable Energy Sources excluding hydropower
RES (incl. hydro)	Renewable Energy Sources including hydropower
Solar PV	Solar Photovoltaic
UNFCCC	United Nations Framework Convention on Climate Change



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# 1

## Introduction

This chapter opens this thesis by providing background information, clarifying the research problem, outlining the research aim, questions and objectives to address the problem, and briefly explaining the structure of the rest of the thesis.

### 1.1 Background

Climate change, characterised by an increase in temperature caused primarily by human greenhouse gas emissions, is one of the most pressing global challenges (IPCC, 2023). Greenhouse gases exist naturally in the Earth's atmosphere and are vital for the survival of life on the planet. However, anthropogenic activities such as the burning of fossil fuels increase the concentration of such gases, which in turn cause heating of the planet (United States Environmental Protection Agency, 2024).

To reduce greenhouse gas emissions and limit global temperature rise, the development of renewable energy sources has accelerated over the past decade. These sources are expected to play an increasingly significant role in the global energy mix, gradually replacing fossil fuels (International Energy Agency, n.d.-g). In support of this transition, many countries have established national targets for renewable energy deployment (International Energy Agency, n.d.-g).

These targets serve as goals to guide and monitor progress towards a cleaner energy future. In some cases, they are reinforced by legally binding international agreements, such as the Kyoto Protocol adopted in 1997 (UNFCCC, 1997). The protocol established binding commitments for limiting greenhouse gas emissions for 37 industrialised countries (UNFCCC, 1997). The Protocol is implemented through what is called 'hard law', which means that it is based on binding obligations. It also implies that the protocol is imposed on the parties using a top-down approach (Popovski, 2018). This expressed itself in the Kyoto Protocol through a process where countries negotiated and signed their own legally binding targets and were held accountable for achieving them (UNFCCC, 1997).

However, this approach did not result in a global emission reduction (Bocquillon & Maltby, 2024), creating a need for a more inclusive bottom-up approach to broaden the participation of countries, including developing ones. For this reason, a new international treaty on climate change, called the Paris Agreement, was adopted in 2015 (Popovski, 2018). The agreement aims to institutionalise the work toward the

mitigation of climate change globally by lowering the threshold for participation and was signed by almost all countries in the world (United Nations, 2015). Under the Paris Agreement, countries are obliged to submit emission reduction targets communicated through what is called Nationally Determined Contributions (NDC's). Here, the agreement does not regulate specific measures for how these targets should be met, nor does it mandate countries to achieve the set targets (United Nations, 2016). However, the agreement does mandate countries to progressively strengthen their targets through a "ratcheting-up" mechanism based on the assumption that more ambitious targets drive better performance and goal attainment (Horowitz, 2016).

## 1.2 Research motivation

In the last 30 years, the seriousness of climate change has been increasingly acknowledged, prompting countries around the world to develop plans and strategies to address its impacts (Svenska FN-förbundet, n.d). Numerous international conventions and climate change policies have been implemented to address the global environmental challenges. As these policies and regulations took shape, the need for effective tools to guide national energy transitions became increasingly evident. One such essential tool is the establishment of clear targets. Target setting has proven to be a strategic mechanism that countries continue to rely on to structure and drive their energy transition efforts. Many of the current targets are set through the Paris Agreement, as mentioned above, which uses the ratcheting-up mechanism. This urges countries to continuously make their targets more ambitious in order to accelerate the country's low-carbon transition.

However, there are still uncertainties regarding the role targets play and how effective they are in accelerating transitions. The ongoing debate within the literature and the lack of studies on the performance of targets show that there exist gaps in knowledge of this topic (see Literature Review for more details on the knowledge gaps regarding the effectiveness of target setting). To make sure that current transitions can be accelerated and improved more knowledge of the complexities of this matter is needed.

## 1.3 Research objectives and questions

The aim of this study is a result of the research motivation mentioned above, and therefore this study aims to deepen the understanding of the effectiveness and role of targets as a tool to accelerate transitions. To achieve this aim, this project focuses on several objectives. Firstly, this project studies how ambitious target setting can alter the effectiveness of low-carbon transitions and affect the performance of targets over time. Secondly, this project analyses how developed and rapidly developing countries set both general and technology specific targets. Then, a comparison in historical performance can be made.

These objectives then result in an insightful analysis evaluating the role target set-

ting plays in national energy transitions. Through research and analysis of renewable energy targets' historical performance, a greater understanding of their function and importance for effective transitions can be found. This understanding will help bridge existing gaps regarding the role of target setting in national energy transitions.

To address the previously described objectives, the following research questions were chosen to focus the aim of this thesis:

- To what extent do ambitious renewable energy targets translate into effective outcomes and how has this developed over time?
- How does the performance differ between technology specific and general targets?
- In what ways, if any, does the setting of a target and the achievement differ between rapidly developing and developed countries?

In order to answer the research questions and to analyse the importance of the targets, this thesis has walked through an introduction which described background information of the topic and clarified the research motivation, objectives and questions of the project.

The following chapter is a literature review, which reviews the literature on targeting renewable energy to identify established facts, prevailing scholarly opinions, and existing gaps in knowledge. The chapter summarises relevant points and analysis from four scientific articles. Then the following method describes how the data was collected and analysed, while also presenting the limitations of the method. The result chapter describes both facts about the countries as well as their history of renewable energy sources. The chapter also presents each country's targets through visualisations and tables. Following the results is the discussion, which reflects on the findings, interprets their significance, and addresses their limitations. The final chapter is the conclusions, summarising the main findings of the project and completing the thesis.



# 2

## Literature Review

This chapter reviews the literature on renewable energy target setting to identify established facts, prevailing scholarly opinions, and existing gaps in knowledge. The section summarises relevant points and analysis from four scientific articles.

The role and effectiveness of renewable energy targets in driving the global energy transition have become central topics in academic and policy debates (International Energy Agency, 2025). As countries seek to use more low-carbon energy sources in their energy systems, targets have emerged as a central tool for planning and influencing policy development. Firstly, researchers have investigated whether intermediate targets contribute meaningfully to the achievement of long-term goals. Secondly, studies have explored how the level of ambition in targets influences policies and their implementation, often through mechanisms of policy feedback. Thirdly, scholars have analysed the political processes behind target setting, including how targets are selected and the extent to which they are based on technical, economic, or ideological considerations.

### 2.1 Frequency in target setting

In the report "Achieving long-term renewable energy goals: Do intermediate targets matter?" researchers used a simulation model of a stylised electricity market to investigate the effect of intermediate targets (Gencer & van Ackere, 2021). The authors describe that previous studies found that intermediate targets increase the likelihood of achieving the long-term target in a cost-effective way. As an example of how the lack of intermediate targets can obstruct target achievement, the study used the case of Ghana, where the country failed to reach its goal of 10% renewable electricity generation due to the absence of clear policy and regulatory authority (Gencer & van Ackere, 2021).

To understand what strategies provide effective outcomes, Gencer and van Ackere conducted a simulation to investigate three different approaches to target setting; one long-term target, a five-year interval for intermediate targets and a yearly interval for intermediate targets. The overall goal in the study was to increase the share of renewable electricity from 3% in 2020 to 50% by 2060. Participants were divided into three groups based on the different approaches and tasked with managing a simulated electricity market (Gencer & van Ackere, 2021). The purpose of creating the simulation was to find the most profitable approach while balancing the risk of

blackouts, costs for customers, and the amount of subsidies. As the analysis is based on a simulation rather than real-world data, it does not constitute an empirical study.

By conducting this study, the authors found that intermediate targets influence how the market develops toward the final goal (Gencer & van Ackere, 2021). The study showed that the presence and frequency of targets affect how regulators make decisions about subsidising green capacity each year. More frequent intermediate targets, such as annual ones, needed more subsidies in both green and thermal capacity than the ones with a five-year interval. Therefore, the five-year interval of intermediate targets was more cost-efficient (Gencer & van Ackere, 2021). However, a yearly interval intermediate target and a long-term target had a lower rate of blackout, a key consideration for policymakers aiming to ensure grid stability during an energy transition. These two approaches also had a higher rate of achievement. (Gencer & van Ackere, 2021).

The study found that intermediate targets did not specifically affect whether or not the long-term target was achieved (Gencer & van Ackere, 2021). However, the study highlights that policymakers should implement intermediate targets, not necessarily to accelerate transitions, but to make transitions more cost efficient when trying to achieve ambitious targets. The writers recommend yearly targets to ensure reaching the targets but emphasise that if there are any budget constraints, a five-year plan should be implemented.

## 2.2 The role of policy design in target setting

While the previous study was based on a simulated analysis, the literature review continues with studies about policy feedback starting with the comprehensive study “Enabling Sustainable energy transitions - Practice of legitimation and accountable governance” which discusses different perspectives on climate targets and sensitivities (Haarstad, 2020).

In the study Haarstad mentions how cities, rather than countries, are at the forefront of local climate mitigation as they set ambitious targets. At the same time Haarstad describes that when cities set highly ambitious goals, it raises questions about their realism and whether such targets reflect genuine commitment or are driven by competition among cities. This can enable politicians to capitalise on climate-sensitive rhetoric without being held accountable for following through or taking action (Haarstad, 2020).

The author also describes climate governance as an "empty signifier", a term used to incorporate climate protection without challenging the foundational structures of the global economy, which is still heavily reliant on fossil fuels. In addition, the study points out that many climate targets are non-binding, making it difficult to evaluate the actual impact of such policy measures (Haarstad, 2020).

Furthermore, Haarstad analyses the role of metrics in climate governance, noting

that numerical targets are often perceived by the public as more concrete and trustworthy than political rhetoric. This, according to the study, is particularly effective in the context of climate change, where scientific data provides measurable indicators and evidence-based strategies for action. However, Haarstad also critiques the broader implications of this reliance on metrics. He argues that while target setting may appear objective, its normalisation can reinforce existing power structures by legitimising specific policy approaches and framing them as the standard route toward sustainability. In this way, metrics can both clarify the issue and subtly constrain the range of acceptable solutions (Haarstad, 2020).

Haarstad analyses the Zero Growth Objective in Norway’s transport policies, which aimed to reduce car usage in major cities by promoting public transport, cycling and walking. The goal was to set a target that was measurable, ambitious, and achievable. Although initially criticised for being overly ambitious, the Zero Growth Objective has since played a meaningful role in normalising sustainable mobility transitions in urban areas (Haarstad, 2020).

Finally, Haarstad’s analysis invites people to consider not only how the targets are set and the reasons behind them, but also what kind of change they enable, and which possibilities they might unintentionally limit.

Another area of research within energy policies that has been studied is how the level of ambition of a target affects the success and the path of implementation. In the article “Do big goals lead to bad policy? How policy feedback explains the failure and success of cellulosic biofuel in the United States“ Breetz discusses how feedback loops affect policy and how unrealistically high goals can trigger weak policy design (Breetz, 2020).

When a legislature considers adopting a policy or target, and it is publicly announced, it typically enters a political cycle: First, competition for political leadership often leads to the proposal of overly ambitious goals, as politicians attempt to outdo each other. These goals are then validated by industry representatives, who support them to demonstrate leadership and competence within their field (Breetz, 2020).

Next, a backlash emerges in response to the unrealistic ambition of the goals. This typically results in the introduction of exemptions, waivers, or more flexible compliance options. In some cases, the scope of what is considered part of the policy is also expanded, as occurred in the case of cellulosic biofuel in the United States, which Breetz discusses. This broadening of the definition of the policy allows more groups to develop a political interest in it, thereby increasing the support for the policy and ultimately fostering greater innovation (Breetz, 2020).

This cycle may be cut short at the second step if the policy is deemed unsuccessful, potentially leading to further entrenchment of old technology. Because of this Breetz cautions policymakers to consider how their announcements and actions may

feed back into how other stakeholders respond to the policy. With this in mind, the policymakers should actively try to shape how their policy is received and consider this in their planning.

If the whole cycle is followed through, one key insight Breetz gives is the importance of maintaining a flexible incentive structure that can facilitate new innovations. This is valuable when considering renewable energy, which is a part of a constantly shifting landscape. This becomes evident as Breetz notes the following about the cycle when reflecting on the broader implications of her study:

“Its experiences cannot be generalised for all energy policies, but they illustrate a potential set of mechanisms that may transpire from highly ambitious energy policies, particularly when the goals rely on new energy technologies” (Breetz, 2020).

When considering how policy is affected by the level of ambition Breetz’s study emphasises the importance of considering the whole policy cycle and how an overly ambitious target may result in pushback that harms the transition to renewable technologies.

Yet another strand of energy policy research investigates how the design of climate policies affects their durability over time, and whether the level of ambition is likely to increase or decrease. In the article “The Role of Policy Design in Policy Continuation and Ratcheting-Up of Policy Ambition”, this dynamic is explored in an analysis of 627 low-carbon energy policies across eight OECD countries (Sewerin et al., 2023), the Organisation for Economic Co-operation and Development, whose member states are economically developed and generally considered prosperous (Statistics Netherlands, n.d). These policies are central in inducing technological change in the power sector, often by promoting renewables or energy efficiency (Sewerin et al., 2023). The authors examine what makes a policy continue or be discontinued and the likelihood of a policy to be ratcheted-up or -down, meaning policies can gradually become stricter or looser, and with a small chance to shift back in the opposite direction. Sewerin et al. therefore developed two hypotheses: the more intense a policy is, the less “sticky” it becomes and intense policies are more likely to be replaced by less ambitious ones, while specific ones are more likely to be strengthened.

Through the statistical analysis, Sewerin et al. found partial support for these assumptions. For example, highly intense policies that impose ratcheting-down, tend to face stronger resistance from incumbent actors, such as established industries. Sewerin et al. argues that this increases the likelihood of policy weakening or discontinuation. On the other hand, more specific policies with narrowly defined instruments seem to create space for new actors and technologies to emerge. This can lead to greater political support and, in some cases, an increase in policy ambition, therefore ratcheting up (Sewerin et al., 2023).

One of the study’s main contributions is to bridge the gap between literature on

policy design and policy feedback. Sewerin et al. states that previous research often focused narrowly on feedback effects, how policies create winners and losers who then affect future political support. Sewerin et al. argues that feedback cannot be understood without considering how policies are originally designed. For example, a vague policy may preserve the status quo, while a more specific targeted one can “shake up” existing structures and lead to transformation (Sewerin et al., 2023).

Although the study focuses on the role of policy design, the results suggest that design features alone do not significantly explain whether a policy survives or not. Sewerin et al. states that this shows that wider political and economic factors affect how long a policy lasts. Still, the authors’ findings on how policy ambition evolves over time - particularly the vulnerability of intense policies being weakened and the possibility of specific policies being strengthened - offer valuable guidance for policymakers seeking to advance climate goals while minimising resistance (Sewerin et al., 2023).

### **2.3 Comparative analysis of the literature**

To conclude this chapter, the different studies highlight the balance between designing ambitious climate policies and ensuring their durability, pointing to the potential of specific measures to gradually increase ambition without provoking resistance.

The studies used different methods of investigating target setting and also shifted in focuses. While Gencer and van Ackere focused on simulating the problem theoretically, Haarstad analysed it critically with a focus on ideology, legitimacy and guiding. Breetz took another approach by studying policy feedback and innovations. The authors also offered a different opinions on what makes a target successful. While the model of Gencer and van Ackere focuses on cost-efficiency and different approaches to target achievement, Breetz highlights the long-term innovation processes and political susceptibility of target policies, while Haarstad problematises their legitimacy and steering function. Sewerin et al. on the other hand made an empirical study of pre-assumed theories about the difference between vague and specific targets.

Both Breetz and Gencer and van Ackere showcase that ambitious goals can trigger weak policy design as seen in the model that was first presented, where ambitious goals that were set with no planned implementation pathway resulted in higher costs. Which, according to Haarstad’s study, would not be a good choice in the real world due to the public interest in minimising disruptions to the economy. Sewerin et al. also brought up the fact that if a policy is not in the favour of an incumbent, the likelihood of the policy being discontinued is high, making it harder for smaller technologies to be integrated into the market and new policies to be publicly accepted.

Something that displays how Sewerin et al. and Breetz approach the subject differently is what kind of policy design they state leads to the best outcome. Sewerin et al. argues that specific technology targets work in favour of innovation and thereby

enables new actors and technologies to establish themselves on the market. On the contrary, Breetz argues that broader policies allow more actors to take part in policy incentives, creating a more favourable environment for innovation. This conflict indicates an uncertainty in the ongoing debate regarding policy design. This thesis aims to contribute with additional knowledge on this matter.

None of the studies mentioned above investigate how the country's stage of development affects policy making or target setting. As all studies focus on highly economically developed countries, there seems to exist an implicit assumption that these patterns apply to all countries. This could represent a knowledge gap, which this project aims to fill. If solved, this could clarify how policymakers should reason when considering global policy.

This chapter reviewed key literature on the role of renewable energy targets in energy transitions. The studies display the importance of setting targets that are realistic and supported by clear plans, rather than creating ambitious goals that are unlikely to be followed in practice. Several authors also point out that if targets are not adjusted to fit existing political and economic conditions, they may end up being symbolic and have little real impact. In addition, the transition to renewable energy can affect current industries and economic interests, which may influence whether a target is continued or abandoned. Future research should focus not only on how targets are designed, but also on how they work in real political and economic settings. Considering how different preconditions of countries can affect target setting, as well as their design and effectiveness in accelerating low-carbon transitions, is the main focus of this thesis.

# 3

## Methods

The following chapter presents the method of this project. After providing a general overview of the project and its starting point, the chapter is structured into four main sections: scope, data collection, data analysis, and limitations of the method.

The thesis examines how countries perform in meeting their targets by selecting a group of low-carbon technologies and collecting their associated targets. The selection was based on the widespread availability of national energy targets and the relative ease of assessing their achievement. As a result, the study focuses on the national renewable energy targets of selected countries. The research is tackled by investigating the historical targets of the chosen countries, where the earliest ones collected were set in 1990.

### 3.1 Geographical, technological and temporal scope

One of the primary purposes of this thesis project is to analyse whether and how different levels of development affect the setting and achievement of renewable energy targets. For this purpose, the study focused on the 18 largest economies after the G20<sup>1</sup> countries, selected on both methodological and empirical merits. Methodologically, these countries offer a more balanced basis for comparison, as they are generally closer in economic size than the G20. Empirically, many of these countries have recently demonstrated some of the fastest growth rates in renewable energy technologies (Suzuki, 2022; Suzuki et al., 2023). However, despite their important role in climate change mitigation, these countries have received relatively little attention in the existing literature, which has predominantly focused on the G20 (Climate Action Tracker, 2024; International Renewable Energy Agency, 2024b) — an important gap this thesis project aims to fill.

To accomplish this the countries were divided into two categories based of the definition by the UNFCCC from 1992 (United Nations Framework Convention on Climate Change, 1992) where countries were categorised as "Annex 1" or "non-Annex 1". The categorisation was made based on the level of industrialisation in countries when responsibility for transitions was assigned. In this report "Annex 1" countries are referred to as "developed countries" and "non-Annex 1" countries as "rapidly developing countries". This was done to help with understanding the reasoning, since Annex 1 might not be a widely understood term. This classification is further discussed in section 5.5.

Following is a table of all the countries included in the study.

**Table 3.1:** Chosen countries with ISO2 codes

Developed	ISO2	Rapidly Developing	ISO2
Austria	AT	Bangladesh	BD
Belgium	BE	Israel	IL
Ireland	IE	Nigeria	NG
Netherlands	NL	Pakistan	PK
Norway	NO	Philippines	PH
Poland	PL	Saudi Arabia	SA
Spain	ES	Taiwan	TW
Sweden	SE	Thailand	TH
Switzerland	CH	Vietnam	VN

## 3.2 Data collection

The study used a quantitative data analysis method to examine the performance of renewable energy targets by comparing set targets with actual developments. The main method involved document analysis, where relevant data was systematically collected, processed, visualised, and compared.

### 3.2.1 Data categorisation

The information collected for each country includes: the specified targets, when it was set, by what year the target was set to be accomplished, and what unit the target specified. It was also noted if the target was part of a sequence of targets that were set at the same time in the same policy document. From the data source two more characteristics of the target were determined: the source and type. These two terms were used as categories to show from what source the energy came from and how it was measured. Below is first a description of all sources collected when searching for targets, followed by a description of all types.

- Hydropower utilises kinetic energy when water flows downstream in a power plant to make a turbine spin, which generates electricity (Killingtveit, 2019). In this study only renewable hydropower generated through low-carbon sources was included. This primarily excludes the use of fossil-fuel driven pumping as energy storage for later hydropower generation.
- Solar power uses energy derived from the sun’s radiation, which can be converted into electricity through large-scale solar power plants. Sunlight is one of

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<sup>1</sup>With the exception of Saudi Arabia which is included in this study despite being a G20 country.

the most abundant and naturally available sources of renewable energy (Fraas & Partain, 2010). In this study, all sources of solar power were included in the collection. If a policy communicates different types of solar power: solar PV and/or concentrated solar power (CSP), these were summarised.

- Wind power is electricity generated by wind running through a wind turbine with thin blades. With the rotation of the blades, electricity is generated from the turbine through a generator (Nationalencyklopedin, n.d.-b). In this study, wind power is categorised into three categories: wind, onshore wind, and offshore wind. "Wind" is defined as both onshore and offshore wind power. "Onshore wind" refers to wind power generated by turbines on land, while "Offshore wind" refers to wind power generated by turbines at sea. If a policy did not specify whether it targeted onshore or offshore wind power the target was assumed to include both types of wind power.
- Ocean energy encompasses all forms of renewable energy derived from the sea. The three main types of ocean energy technologies are wave energy, tidal energy, and ocean thermal energy. Wave and tidal energy are extracted through the movement of water, while ocean thermal energy uses the temperature difference between warm surface water and cold deep water to generate power (Australian Renewable Energy Agency, 2024).
- Biomass power refers to energy generated from organic materials using technologies that convert biomass through processes such as combustion, bacterial decomposition, or transformation into liquid biofuels (Bauen et al., 2009).
- Geothermal energy is energy contained and extracted from the crust of the earth (Nationalencyklopedin, n.d.-a).
- RES (incl. hydro) is energy from all sources deemed renewable including hydropower.
- RES (excl. hydro) is energy from all sources deemed renewable with the exception of hydropower.
- RES-E (incl. hydro) is electricity from all sources deemed renewable including hydropower.

Below is a complete summary of all sources that were primarily collected.

**Table 3.2:** List of all source categories

<b>Sources</b>
Hydropower
Solar power
Wind power
Onshore wind power
Offshore wind power
Ocean power
Biomass power
Geothermal power
RES (incl. hydro)
RES (excl. hydro)
RES-E (incl. hydro)

Below is a list of the types mainly studied in this thesis, followed by a complete table of all types primarily collected.

- **The share of renewables** in final energy consumption, electricity generation, installed capacity, primary energy, and/or electricity (%).
- **The targeted electricity generation** from renewables (MWh, GWh, TWh).
- **The target installed capacity** of renewables (MW, GW).

**Table 3.3:** List of all type categories

<b>Type</b>
Electricity generation
Installed capacity
Gross final energy consumption
Gross final electricity consumption
Primary energy supply
Electricity generation share
Installed capacity share
Primary energy share
Electricity supply
Electricity supply share

### 3.2.2 Method for data collection

Data collection was initially done by reviewing the REN21 Renewables Global Status Reports from 2005 until 2023. Thereafter, data was gathered from international collaborations such as EU-directives and ASEAN agreements. Lastly, data was gathered and verified from each countries national policies, plans and legislations. For some countries the information available from official sources was insufficient and in that case academic papers was used.

In order to identify relevant documents, a strategy was employed where online tools were used to translate key terms, such as “renewable energy targets”, into the respective country’s local language. These translated terms were then used for online searches. When a potentially relevant document was found, resources like Google Translate were used to translate it into Swedish or English. In some cases, AI tools like NotebookLM were used to summarise and translate the document, highlighting sections where key terms appear. These sections were then manually reviewed to ensure accurate interpretation and assess the document’s relevance. This manner of translation should be taken into consideration as this may be a source of error.

Every target was verified by comparing it to the official documents and resolutions from the country. The main reason behind this was to strengthen the reliability of the targets. If the data was extracted directly from a research paper then there might be misinterpretations of the target.

Below is the template that was used for collecting information about the different countries’ national targets. Six policies from three different countries were used to demonstrate the usage of the template. In this version, the data source and URL link have been removed for readability.

**Table 3.4:** Energy policies and their details.

Country	ISO2	Policy Name	Year0 <sup>2</sup>	Year1 <sup>3</sup>	Source	Type	Unit	Value
<b>Switzerland</b>								
	CH	Energiegesetz	2000	2030	Hydropower	EG <sup>4</sup>	GWh	2000.0
	CH	E2000	1990	2000	RES (incl. hydro)	GFEC <sup>5</sup>	%	0.5
<b>Poland</b>								
	PL	NREAP (2010)	2010	2020	Hydropower	IC <sup>6</sup>	MW	1152.0
	PL	NREAP (2010)	2010	2020	Biomass	EG	GWh	14218.0
<b>Israel</b>								
	IL	Resolution 4450	2009	2020	RES (excl. hydro)	EGS <sup>7</sup>	%	10.0
	IL	Decision 542	2015	2025	RES (excl. hydro)	EGS	%	13.0

Data of the actual expansion and use of renewable energy was sourced from IRENA

<sup>2</sup>Year0: Year announced

<sup>3</sup>Year1: Year targeted

<sup>4</sup>EG: Electricity generation

<sup>5</sup>GFEC: Gross final energy consumption

<sup>6</sup>IC: Installed capacity

<sup>7</sup>EGS: Electricity generation share

and Eurostat. Linearly extrapolated data acquired from the five latest years of actual data, stretching to 2030, was sourced from IRENA. For certain years the IRENA and Eurostat data was insufficient and complementary data needed to be manually added. This data is presented in the appendix under a section called "Additional data points". Combined with the IRENA and Eurostat data this data was then compared to the collected targets.

### 3.3 Data analysis

This section describes how the data was analysed to identify patterns, trends, and relationships for different countries and targets over time.

#### 3.3.1 Data selection

After the target data was been collected it was manually sorted to select the targets with sufficient prevalence to merit a comparison. In the selection it was also taken into account the time available to analyse the data to narrow down the selection. Below are the sources and types selected for analysis:

**Table 3.5:** List of all selected source categories

Sources
Solar power
Wind power
Onshore wind power
Offshore wind power
RES (incl. hydro)
RES (excl. hydro)
RES-E (incl. hydro)

**Table 3.6:** List of all selected type categories

Type
Electricity generation
Electricity generation share
Installed capacity
Installed capacity share
Gross final energy consumption
Gross final electricity consumption

### 3.3.2 Performance metric

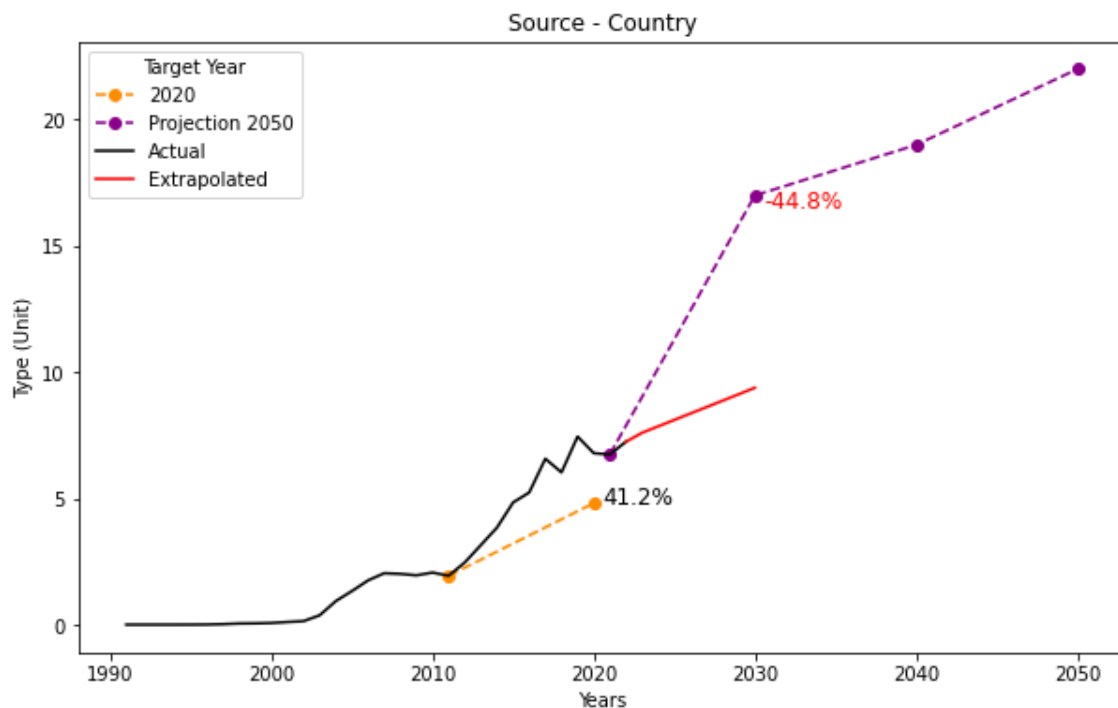
After the data was sorted it was further analysed and plotted in order to measure each country's performance in meeting set targets. To get an actual value on the countries performances the following equation was used:

$$\text{Performance} = \frac{\text{Actual Value} - \text{Targeted Value}}{\text{Targeted Value}} \times 100$$

The performance is expressed as a percentage, where 0% indicates exactly reaching the set target. A positive value represents an overachievement in percentage terms, while a negative value indicates an underachievement. This value is displayed in the visualisations for each country in the result chapter.

### 3.3.3 How to interpret the visualisations

The data was visualised through visualisations that compared the selected countries' targets with actual data. The visualisations were structured as shown in the example visualisation below:



**Figure 3.1:** Example visualisation

Each country is presented alongside its corresponding visualisations. On the x-axis the chosen time, ranging from 1990 to 2050, is displayed. The source and country is stated above the visualisation (seen as "Source -Country" in the example visualisation). The type and unit is situated on the y-axis, (seen as "Type - Unit"). The interval on the y-axis differ between the visualisations to best match the range

of the actual data and display it as accurately as possible. In the visualisations, the black line shows the actual data, which displays the relationship between the x-axis and the y-axis. The red line represents the extrapolated data stretching to 2030. The dotted lines connect the year in which the targets were set with the years they were set for. If multiple targets were set on the same year under the same scenario or direction, but for different years in the future, the lines are combined to one line, and is called a projection. A performance score, calculated with the formula described above, occurs if the country has set a target within the interval where there exists actual data. This is displayed in percentage terms beside the relevant target. If the performance score uses extrapolated data, the score is displayed in red. Seen in the example visualisation where the first target used actual data and is displayed as 41.2% while the second uses extrapolated data and is shown in red as -44.8%. If the performance score is positive it is an overachievement, as seen in the first target, and if the score is negative it is an underachievement, as seen in the second target.

#### 3.3.4 How to interpret the tables

To facilitate comparison between countries the average performance for each country was calculated across three categories. First "general targets", referring to targets for all renewable energy sources, including all RES and RES-E targets. Second, "technology specific targets", which cover solar and wind power only. Finally these two targets are combined into one, called "All targets", representing the average achievement of all targets for each country. This is shown in the example table below.

**Table 3.7:** Average performance for Example country over the time periods: 1990-2009, 2010-2015 and 2016-2024, and for the categories: "All targets", "General targets", "Technology specific targets".

Category	1990–2009	2010–2015	2016–2024
All targets	50%	-70%	74%
General targets	50%	-70%	189%
Technology specific targets	-	-	-40%

The performance rates are presented in tables for each country and in a combined visualisation where a comparison across countries is made. When there exist no target for the specified category and time period this was marked by a "-".

### 3.4 Limitations of the method

As a result of limiting the scope of this project, the number of countries included in the analysis was narrowed to 18. Consequently, the findings should not be interpreted as a comprehensive representation of global target setting practices. Furthermore, as the study focused primarily on electricity, with some targets regarding primary energy collected, other aspects of the renewable energy transition, such as

transport, building and agriculture sectors were excluded. This may limit the applicability of the study in other sectors.

Another limiting factor is the lack of data across all countries. Notably, this shortfall is unevenly distributed, with some countries having extensive data availability, while others have a more limited supply, as was the case in the United Arab Emirates. The country was initially included in the data collection, but was later replaced by Saudi Arabia due to limited available information. This type of issue affects the extent to which all countries can be equally studied and subsequently compared. This may be due to some countries having implemented renewable energy relatively recently and thus lacking a history of target setting. Another reason for the difficulty of obtaining data may be because of the language barrier limiting our access to data only available in the country's native language, thereby complicating the research process. For some countries there was restricted access to documents about renewable energy, with the reasoning ranging from security concerns to policy shifts within the country.

Yet another limitation to consider is that most translations from languages other than English or Swedish were conducted using online translation tools, such as DeepL and Google Translate, which in turn can cause misinterpretations.

The final thing to note is that some countries had targets with such drastic overachievement that the effect on the performance calculation constituted a source of error. Therefore, any performance score over 1000% was removed to better represent the spirit of the data, however, some significant overachievements are still included. The reasons for this high overachievement is included in section 5.5 in the discussion.

### **3.5 Summary**

In summary, this chapter has outlined the method used to investigate how effectively countries have met their renewable energy targets. Through a structured process of data collection, categorisation, analysis and visualisation, the study aims to provide a comparative understanding of national performances. Although the method is robust and data-driven, limitations such as data availability, translation challenges, and scope selection should be considered when interpreting the results. These constraints are further reflected upon in the discussion section.



# 4

## Results

The following chapter presents the results of the chosen countries. To view the full collection of targets, see the Appendix available at the very end of the report. The individual results are presented in the following order: countries in the EU, other European countries (often in collaboration with the EU), countries that are part of ASEAN, other Asian countries and lastly one remaining country. The project presents, for each country, background regarding their current and historical energy and electricity. This chapter includes visualisations which show each country's targets and their actual data alongside the calculated performance. A table for each country summarises the performance for all targets, both general and technology specific over time. Finally, the project analyses findings in the visualisations.

The last section of the results presents nine comparative visualisations that shows summarised performance data across countries for all, general and technology specific targets over three time periods.

### 4.1 Individual country analysis

Many of the studied countries are part of an international cooperation, such as the EU or ASEAN. The EU has several key purposes, including promoting peace, strengthening the economy, and improving the environment (European Union, n.d-b). One of the ways the EU contributes to environmental improvement is through legally binding directives that member countries must adhere to. However, the responsibility for implementation and compliance lies with the individual countries (Riksdagen, 2023).

All countries classified as developed included in this project are members of the EU, with the exception of Norway and Switzerland (European Union, n.d-a). However, Norway is a member of the EEA, meaning that Norway has the right to EU's internal market and can trade services and goods like any other EU member. Norway also cooperates with EU in areas such as science, culture and the environment (Norges Regjering, 2025). Some of the EU directives are legally binding for the EEA countries as well (Norway's Government, 2025). An example of a directive that is legally binding for both EU-countries and EEA-countries is the directive 2009/28/EC. This directive stated, among other things, that 20% of all energy in the EU should be from renewable energy sources in the year 2020 (European Union, 2009). Due to this directive, members of the EU needed to submit a National Renewable Action

plan (NREAP) describing how they were going to achieve their targets for 2020 (International Energy Agency, 2018). In 2018 EU introduced National Energy and Climate Plans (NECP) in where countries stated targets for 2030 and their plan to achieve them. (European Commission, n.d).

A cooperation similar to the EU exists in Asia, ASEAN. Member states include the Philippines, Thailand and Vietnam, along seven other countries in the region. ASEAN is an association that works within different areas, such as environmental issues. Together members try to improve the environment by sharing policies, research and technology among one another (Association of Southeast Asian Nations, n.d).

This section described general characteristics of the studied countries. The following sections conduct individual country analysis.

### 4.1.1 Austria

Austria aims for climate neutrality by 2040 and in order to achieve this, Austria targets 100% renewable electricity supply by 2030 (International Energy Agency, n.d.-c). In 2022, the renewable share of electricity generation was about 80% and hydropower was the largest source (International Energy Agency, n.d.-a). In 2023 roughly 40% of the gross final energy consumption came from renewable energy sources (Statistics Austria, 2025). The share of renewable energy sources has increased in the past decade and the future looks set to follow the same trend (Statistics Austria, 2025).

Austria is a member of the EU and in order to meet national and EU targets, hydropower has an important role in Austria's transition to a fossil-fuel free future (Wagner et al., 2015). Although hydropower forms an important foundation for the country's energy mix, Austria has begun to scale up its solar and wind power with the expectation of being able to increase its capacity by several TWh by 2030 (European Parliament, 2024).

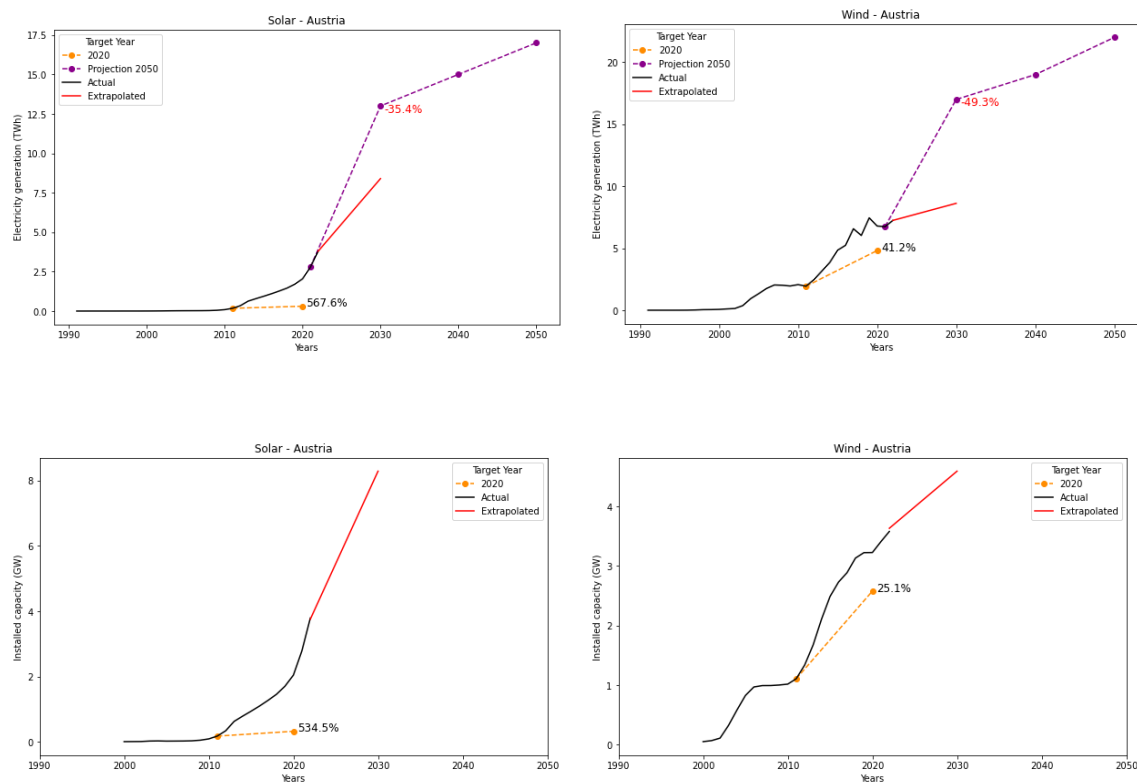
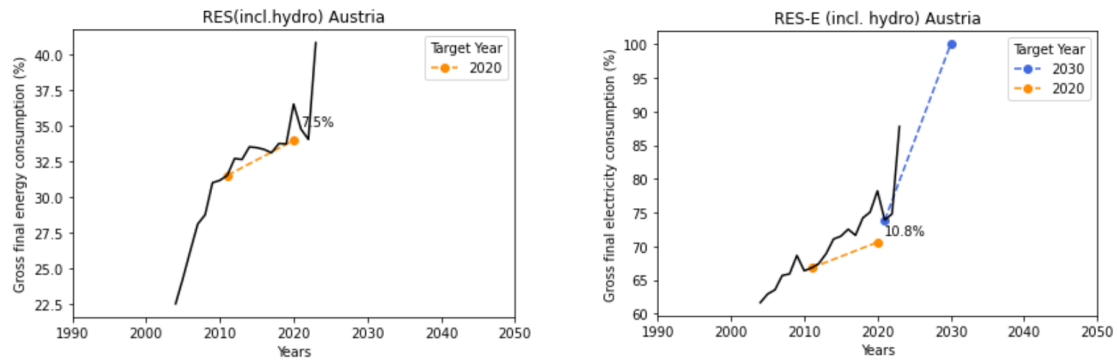


Figure 4.1: Visualisation of Austria's data.

## 4. Results



**Figure 4.2:** Continued visualisation of Austria's data.

**Table 4.1:** Average performance for Austria over the time periods: 1990-2009, 2010-2015 and 2016-2024, and for the categories: 'All targets', 'General targets', 'Technology specific targets'.

Category	1990–2009	2010–2015	2016–2024
All targets	-	-	197%
General targets	-	-	9%
Technology specific targets	-	-	292%

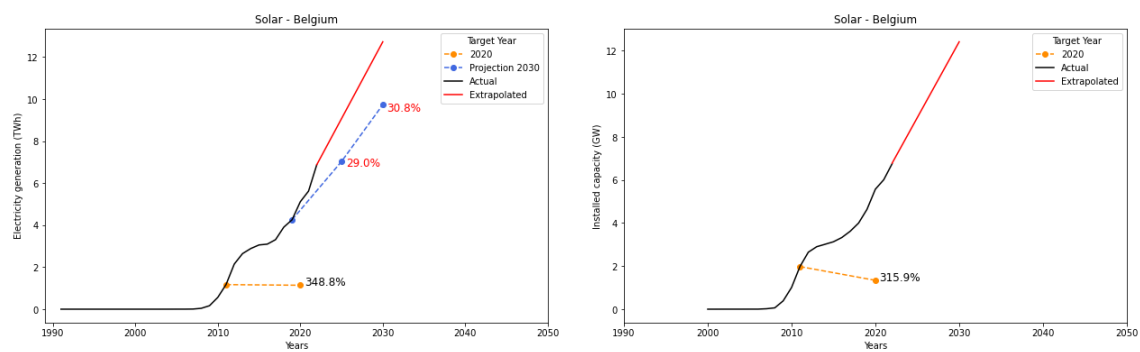
For a full explanation of how to interpret the table and the visualisations see section 3.3.3. The visualisations shows that for wind and solar power Austria meets its targets with good margin until year 2020. However, it seems that Austria will not meet its future targets. As mentioned above Austria has increased and will continue to increase solar and wind power, but not at the speed that was anticipated. One can tell that hydropower has an important role in the energy sector since the total energy is much higher than solar and wind power. From the year 2021 the share of renewable energy goes straight up, which is the same for gross final electricity consumption. This could also be spotted in the table where it shows that Austria had a much higher performance regarding technology specific targets than for general targets. This could be due to the large increase in solar power which resulted in an increase by several percentage points. The general targets brought down the total performance, where both the categories are included, since the achievement of general targets was lower.

## 4.1.2 Belgium

Belgium is a country that heavily relies on nuclear and natural gas for energy and electricity. Belgium determined to phase out all nuclear power by the year 2025, but because of new plans the phaseout of nuclear plants has been postponed (World nuclear association, 2025). Renewable energy sources have not played a major role, only accounting for 12% of the total energy consumption in 2021, but have increased with several percentage points since the start of the 2000's and seem to follow a similar trend in the future (International Energy Agency, n.d-d).

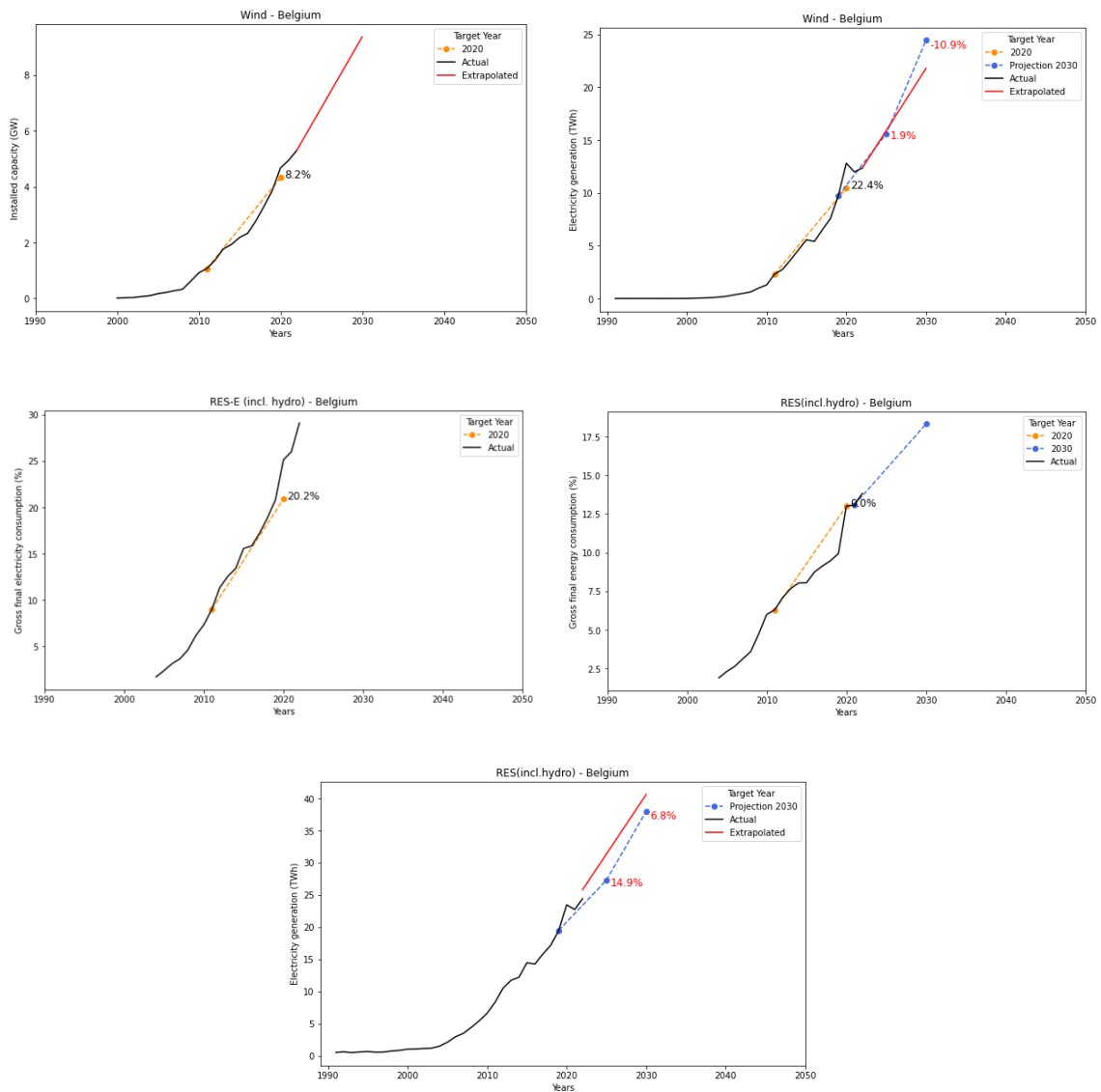
Wind power, especially offshore wind, is an important factor causing Belgium's increased use of renewables in the last couple of years (International Energy Agency, n.d.-b). Wind power accounted for 64% of the renewable electricity generation in 2021 and Belgium is considered a global leader in offshore wind power. In the early 2000s, the country also started to expand solar power, which has increased ever since (International Energy Agency, n.d.-b).

Belgium is a member of the EU and Belgium's capital, Brussels, is seen as the EU's capital since its head office is located there. Belgium is divided into three regions; Flanders, Brussels Capital and Wallonia (European union, n.d). The responsibility of energy policies is shared between the three regions and the federal government. The division of these four parts, where the competence varies a lot, has created some coordination problems and lack of a coherent vision (Van de Graaf et al., 2022).



**Figure 4.3:** Visualisation of Belgium's data.

## 4. Results



**Figure 4.4:** Continued visualisation of Belgium's data.

**Table 4.2:** Average performance for Belgium over the time periods: 1990-2009, 2010-2015 and 2016-2024, and for the categories: 'All targets', 'General targets', 'Technology specific targets'.

Category	1990–2009	2010–2015	2016–2024
All targets	-	-	173%
General targets	-	-	60%
Technology specific targets	-	-	135%

For a full explanation of how to interpret the table and the visualisations see section 3.3.3. As seen in the visualisations above, solar power began to increase around 2010, which may be linked to Directive 2009/28/EC, a binding legislation that required countries to expand their renewable energy sources. The visualisations of the

targets compared to the actual development of solar power indicate that Belgium did not anticipate such significant development by 2020. However, it now appears that the country is following a trend of rapid growth over the next few years. The visualisations of RES(incl.hydro) and RES-E(incl.hydro) show that renewable energy in Belgium has increased a lot after 2009, which could be explained by the directive. In particular, wind and solar power have both increased significantly. The table shows that Belgium has a higher achievement of technology specific targets than general ones, which could be explained by the unexpected increase of solar power. As mentioned earlier, Belgium is working to phase out all of its nuclear power plants as well as fossil fuels. As a result, the country needs to rely on alternative energy sources, which could explain the significant increase and continued high targets in solar and wind energy.

### 4.1.3 Ireland

Ireland is a technologically advanced country with a modern electricity grid and ambitious climate goals (Barton et al., 2020). Ireland is a member of the EU. With a population of around five million, Ireland has a relatively high energy demand per capita (Enerdata, 2023a). Historically, the country has been dependent on fossil fuels, especially imported natural gas and peat, but over the past two decades it has made major investments in wind power (International Energy Agency, 2022b).

As of 2022, about 40 percent of Ireland’s electricity generation came from renewable energy sources. The dominant source is wind power, which accounted for 88% of all renewable electricity generation (International Energy Agency, 2022b). Solar power is used to a much lesser extent, partly due to Ireland’s often cloudy and rainy weather (Devine et al., 2018). However, solar power is considered to have future potential for further development (Joshi & Deane, 2022). Hydropower is limited, mainly due to the country’s geography and lack of large rivers with elevation changes (Devine et al., 2018).

The expansion of renewable energy gained real momentum in the 2000s. Ireland has invested heavily in onshore wind power and is now planning a major expansion of offshore wind (Government of Ireland, 2022). The government has introduced various support schemes and financial incentives to promote sustainable electricity generation (Department of Enterprise, Trade and Employment, 2025).

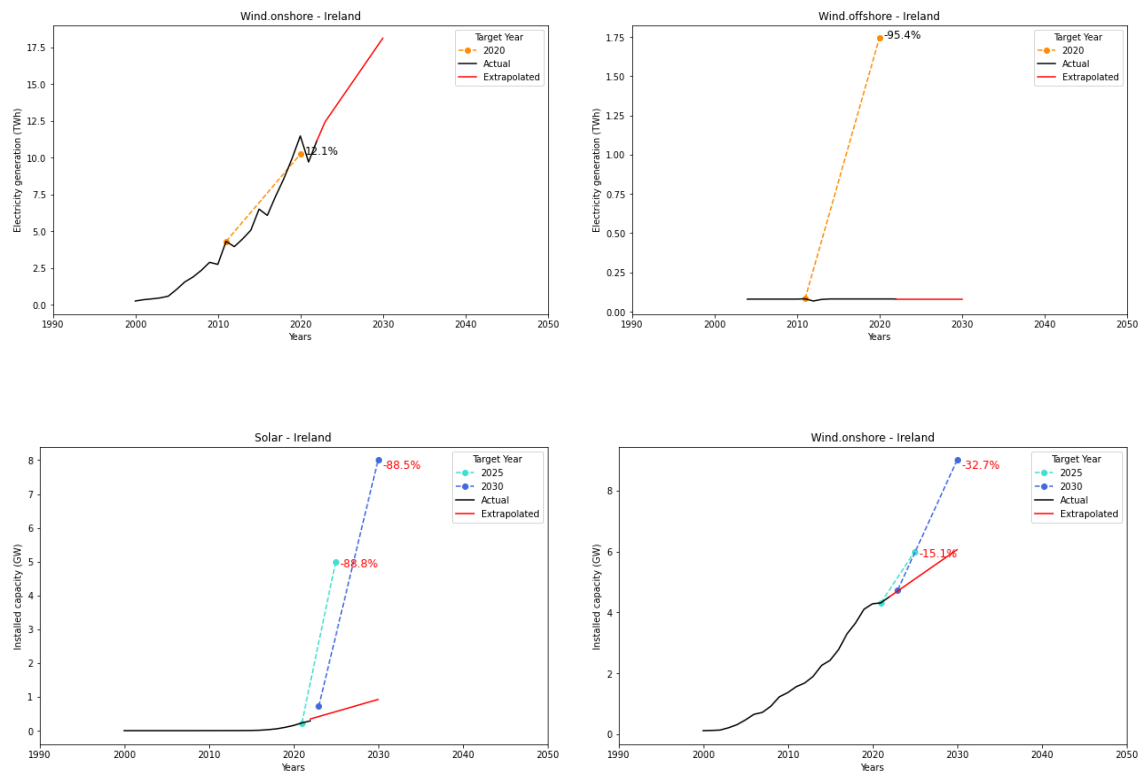
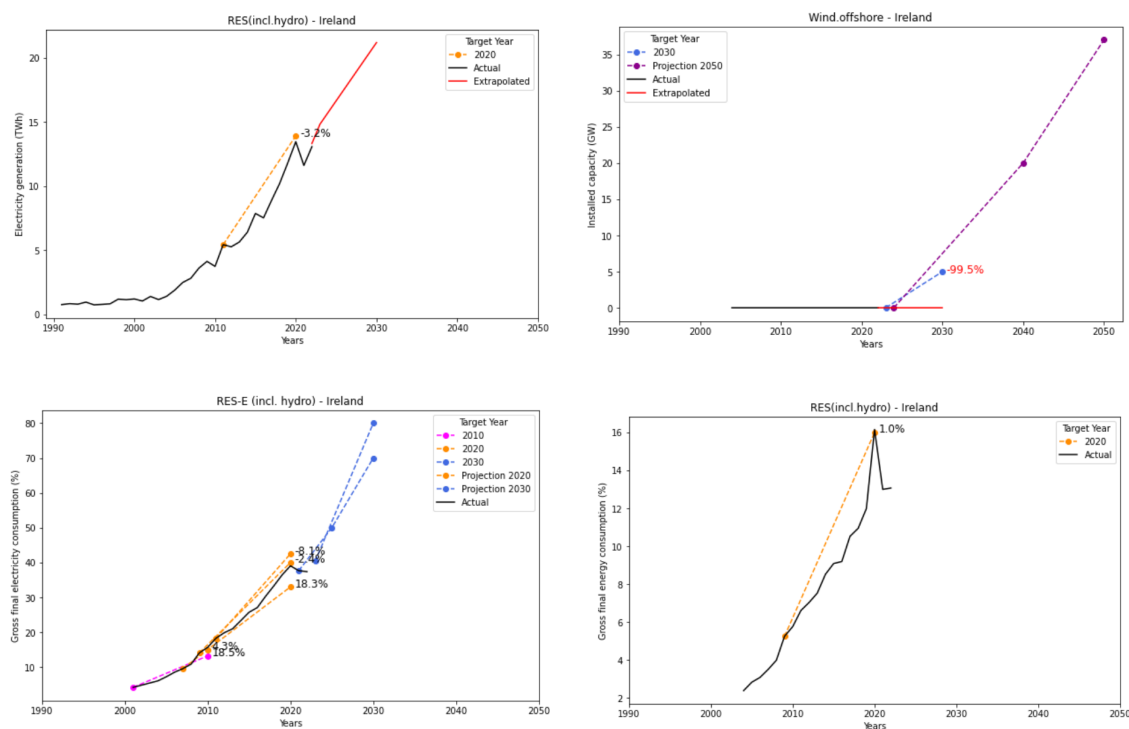


Figure 4.5: Visualisation of Ireland’s data.



**Figure 4.6:** Continued visualisation of Ireland’s data.

**Table 4.3:** Average performance for Ireland over the time periods: 1990–2009, 2010–2015 and 2016–2024, and for the categories: ‘All targets’, ‘General targets’, ‘Technology specific targets’.

Category	1990–2009	2010–2015	2016–2024
All targets	-	11%	-12%
General targets	-	11%	2%
Technology specific targets	-	-	-41%

For a full explanation of how to interpret the table and the visualisations see section 3.3.3. The visualisation indicates that Ireland has performed relatively well in meeting its various renewable energy targets. In most cases, the country has neither significantly underachieved nor overachieved its set targets. One notable exception is the offshore wind target set for 2020, which was underachieved by a significant margin.

Looking ahead, the results suggest mixed progress. When it comes to gross final electricity consumption, the current development appears to be broadly aligned with the future targets. It is also worth noting that this category has had several intermediate targets in the past, possibly contributing to a more stable progress. In contrast, the future targets related to solar power and offshore wind are unlikely to be met based on current trends. Without accelerated investment and policy shifts, these areas risk falling short of the national ambition. The table shows that the

#### 4. Results

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performance rate has decreased in the later time period, general targets are still met but technology specific targets are underachieved, mainly due to Ireland significantly falling short of the target for offshore wind power.

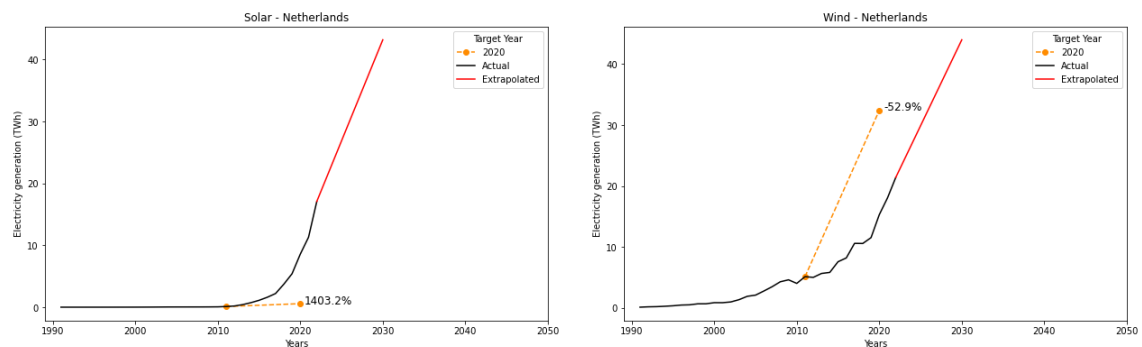
### 4.1.4 Netherlands

The Netherlands has ambitious climate policies aligned with EU targets (Government of the Netherlands, n.d.). However, the Netherlands has long been one of the EU countries with the lowest share of renewable energy in its overall energy mix (Eurostat, n.d.).

As of 2022, the share of renewable electricity generation in the Netherlands was approximately 36% (International Energy Agency, 2022c). Historically, the country has been heavily dependent on natural gas, particularly from the large Groningen gas field (Breunese et al., 2005), as well as coal-fired power (International Energy Agency, 2022c). However, in recent years, a transition has begun, with increasing investments in solar and wind power, especially in offshore wind as a future strategy (International Energy Agency, 2022c).

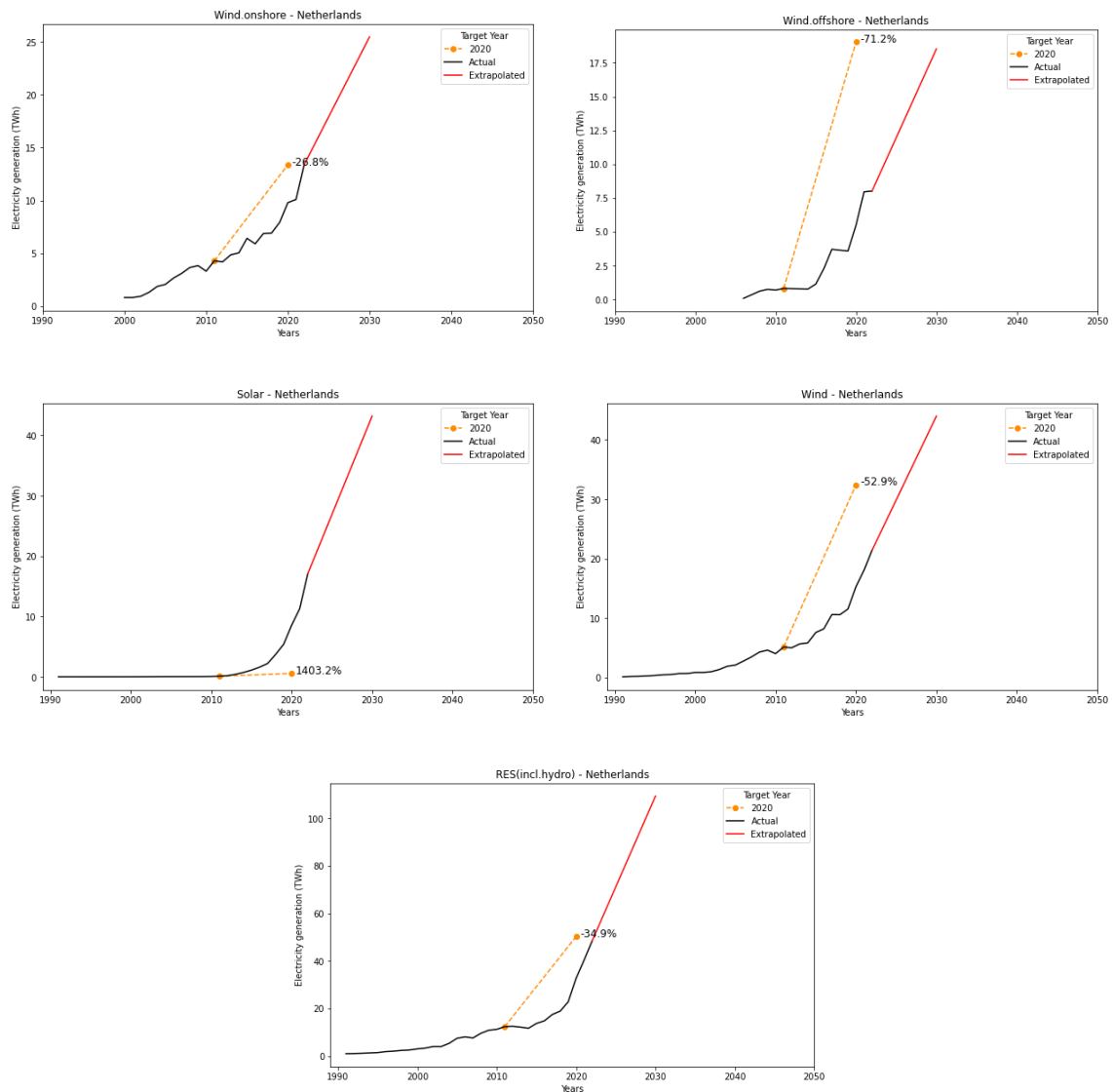
The dominant sources of renewable electricity in the Netherlands are solar and wind power, which together account for nearly all renewable electricity generation. Hydropower plays a very minor role, due to the country's flat topography and lack of significant elevation changes (International Energy Agency, 2022c).

Although the energy transition has progressed slowly in the Netherlands, it has gained momentum since the 2010s (International Energy Agency, 2022c). The country has made substantial investments in rooftop solar installations and is scaling up its offshore wind sector (Simonetti et al., 2024). The government has introduced various support schemes, including subsidies and green certificates, to accelerate the shift toward renewable energy (International Energy Agency, 2012).



**Figure 4.7:** Visualisation of the Netherlands' data.

## 4. Results



**Figure 4.8:** Continued visualisation of the Netherlands' data.

**Table 4.4:** Average performance for the Netherlands over the time periods: 1990-2009, 2010-2015 and 2016-2024, and for the categories: 'All targets', 'General targets', 'Technology specific targets'.

Category	1990–2009	2010–2015	2016–2024
All targets	-	6%	-31%
General targets	-	6%	-16%
Technology specific targets	-	-	-50%

For a full explanation of how to interpret the table and the visualisations see section 3.3.3. The visualisation shows that the Netherlands has made steady progress toward its renewable energy targets. Several targets have been reached although

some with a slight delay compared to the original timelines, for example for wind power and renewable electricity share (RES). One key insight is that solar power was initially underestimated. The actual development has outpaced early expectations, highlighting the sector's growing potential and the success of national support schemes. Another notable trend is that offshore wind is experiencing strong growth. Although the 2020 target was missed, electricity generation from offshore wind is now increasing steadily and in line with the target, with some delay.

The table shows that the performance rate has decreased for the later time period. After overachieving the targets in 2010-2015, the Netherlands underachieved both general and technology specific targets in 2016-2024.

Overall, the trajectory of renewable energy development in the Netherlands appears to be closely aligned with the targets. This suggests that national energy planning and policymaking are effectively driven by long-term strategies, and that there is a clear institutional commitment to reaching the set goals.

### 4.1.5 Poland

Poland joined the EU in 2004 (European Union, n.d.) meaning that they joined later than most other EU countries mentioned in this report. The total electricity production in Poland was 166.401 TWh in 2023, and in 2022 21.1% of generated electricity came from renewable sources. The electricity generation from renewable non-combustible sources was made up of 9.7% hydropower, 60.7% wind power and 29.6% solar PV in 2023 (International Energy Agency, n.d.-f). However, Poland is very dependent upon energy sources such as coal and lignite, and there are still several factors counteracting the ongoing energy transition. One of those is the general lack of knowledge about renewable energy technologies and another is the objection of the coal lobby (Iglinski et al., 2022).

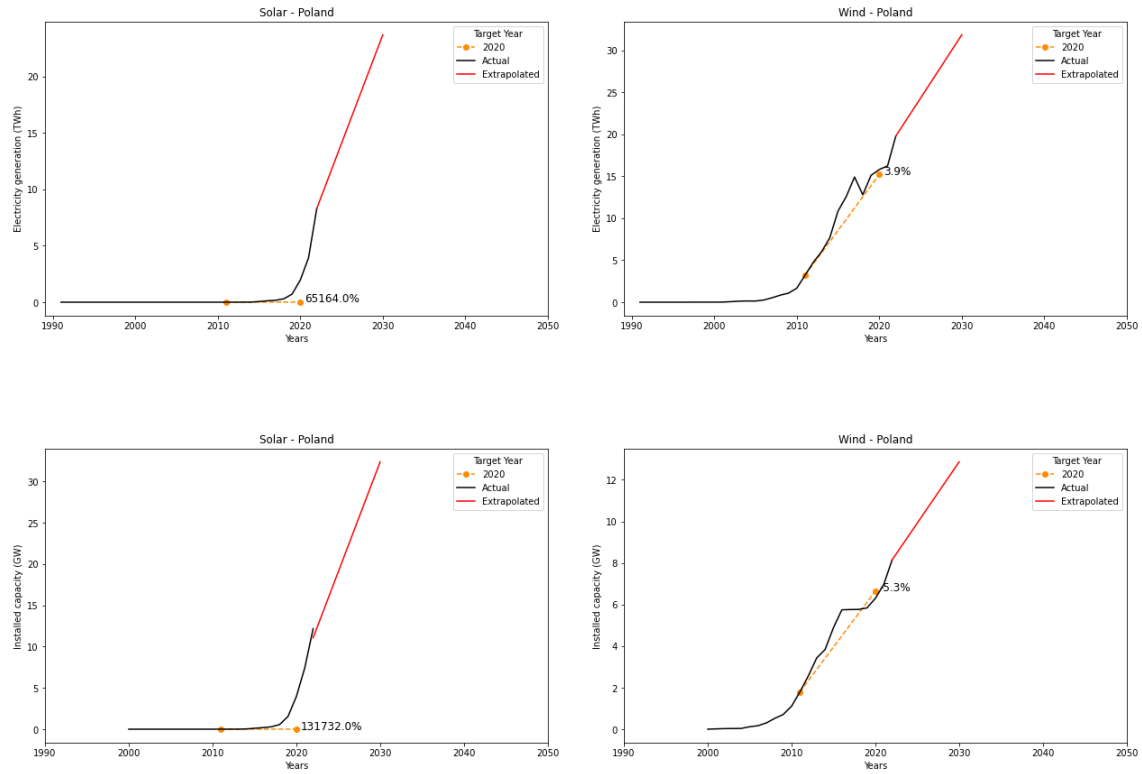
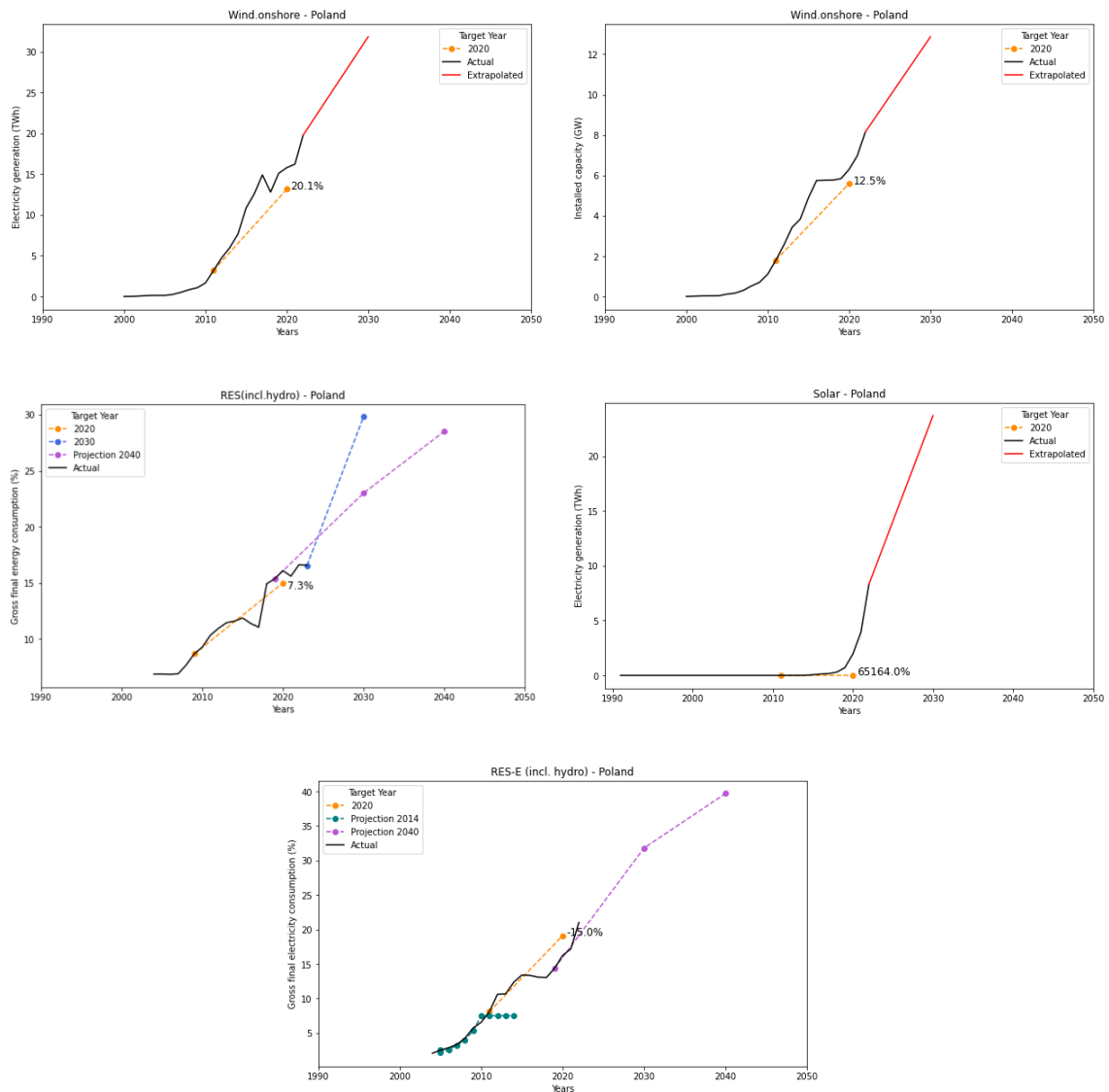


Figure 4.9: Visualisation of Poland's data.



(a) See the footnote <sup>9</sup>.

**Figure 4.10:** Continued visualisation of Poland’s data.

<sup>9</sup>For the fourth plot on this page the calculated performance for Poland’s projection for 2014 was excluded to give better visualisation. These values will be given here instead. Poland’s projection for 2014 had the following accuracies for the following years: 14.2% in 2005, 10.0% in 2006, 3.6% in 2007, 6.2% in 2008, 7.8% in 2009, -12.7% in 2010, 7.7% in 2011, 41.5% in 2012, 42.3% in 2013 and 64.8% in 2014.

**Table 4.5:** Average performance for Poland over the time periods: 1990-2009, 2010-2015 and 2016-2024, and for the categories: 'All targets', 'General targets', 'Technology specific targets'.

Category	1990–2009	2010–2015	2016–2024
All targets	8%	28%	1%
General targets	8%	28%	-6%
Technology specific targets	-	-	7%

For a full explanation of how to interpret the table and the visualisations see section 3.3.3. After observing the visualisations of Poland's set targets and their actually achieved numbers, it seems that the country performs quite well. Overall, it appears that Poland achieves, or gets very close to achieving, many of its targets. Firstly, when analysing the solar targets it is clear that the use of solar power as a source increased more than Poland expected, and that goes for all types of solar targets. This caused significant overachievement of the set targets for solar power. Secondly, when taking a closer look at the wind targets Poland is performing very well, achieving almost all of them and overachieving some. When observing the extrapolated data for both solar and wind technologies it also seems that Poland is following a good trajectory for future performance since its extrapolated data lines up quite well with trajectories of previous targets. Overall, Poland appears to be making steady progress, where their actual numbers are rising almost continuously.

Moving on to the RES targets, where hydropower is included, the visualisations show similar patterns as mentioned before. The overall performance seems good where targets are achieved or are close to being achieved. The projections for future targets also seem to line up well with current actual progress, which makes Poland's current direction seem adequate.

When adding the perspective of table 4.5 it seems that Poland is still making progress and continuously overachieving, even though the percentage of overachievement has decreased in the latest time period. Worth noting is that the solar targets showing extreme overachievement, more than 1000%, were excluded from analysis of performance in table 4.5 since the calculations do not take into account that small targets and high overachievement causes unrepresentative percentages.

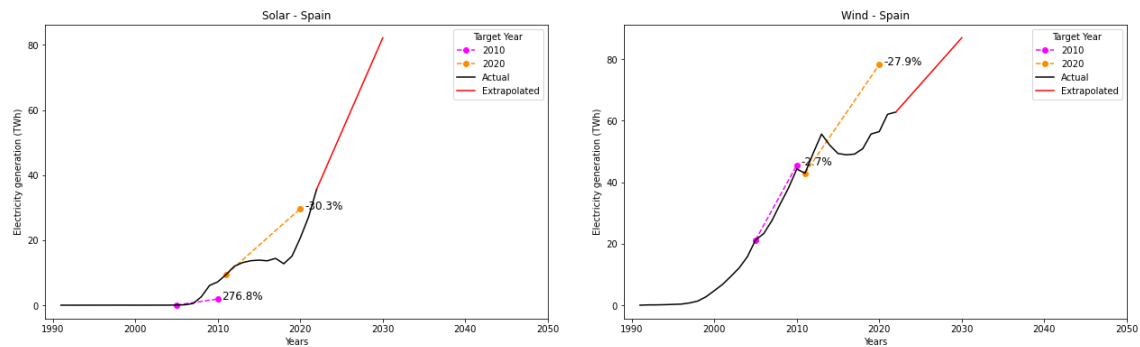
### 4.1.6 Spain

Spain is a technologically advanced country with a well-developed electricity system (Red Eléctrica de España, 2024) and ambitious climate targets (Enerdata, 2023b). The country is a member of the EU. Spain has favourable natural conditions for renewable energy, particularly solar and wind power, due to its warm and windy climate (International Energy Agency, 2022d).

Historically, Spain was an early mover in the renewable energy sector, with large-scale wind and solar farms constructed as early as the 1990s and 2000s. During the 2010s, progress slowed somewhat due to political and economic challenges, but since 2018, investments in renewables have accelerated significantly (Eurostat, n.d.).

As of 2022, renewable sources accounted for approximately 43% of Spain's electricity generation (International Energy Agency, 2022d). The most important source is wind power, which made up 45% of renewable electricity, followed by solar power (30%) and hydropower (20%). Spain's mountainous geography makes hydropower more significant than in many other EU countries (International Energy Agency, 2022d).

The country also has strong potential for further solar development, especially in the southern regions. The government has introduced support schemes to encourage both large-scale installations and rooftop solar systems (Sánchez-Durán et al., 2019). Spain has also begun developing offshore wind power, although this remains in the early stages of implementation (International Energy Agency, 2022d).



**Figure 4.11:** Visualisation of Spain's data.

## 4. Results

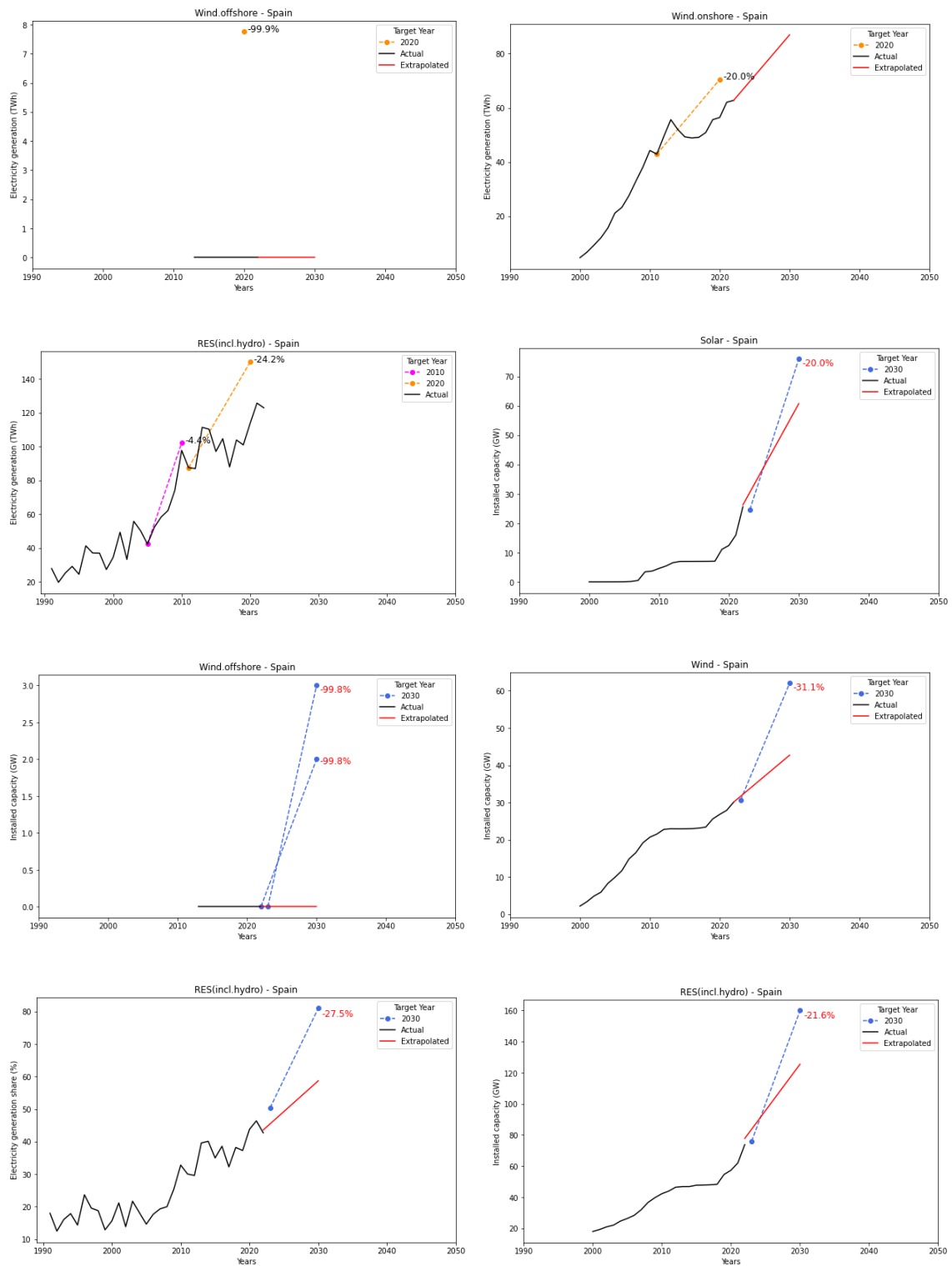
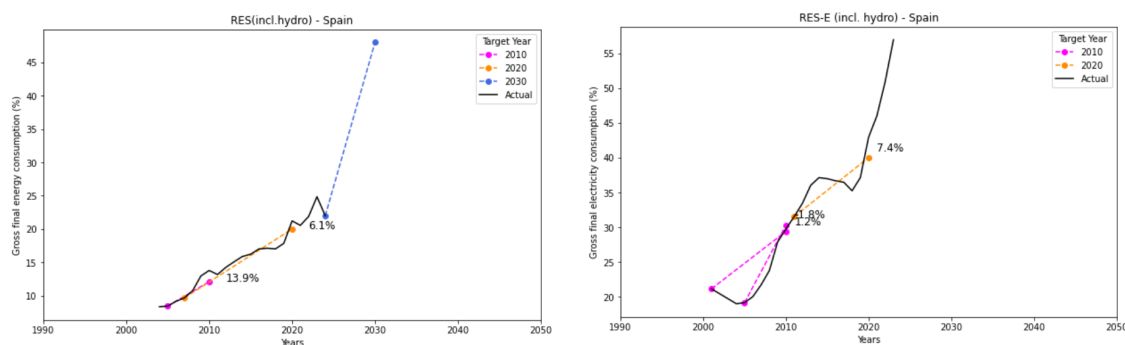


Figure 4.12: Continued visualisation of Spain's data.



**Figure 4.13:** Continued visualisation of Spain's data.

**Table 4.6:** Average performance for Spain over the time periods: 1990-2009, 2010-2015 and 2016-2024, and for the categories: 'All targets', 'General targets', 'Technology specific targets'.

Category	1990–2009	2010–2015	2016–2024
All targets	-	47%	-26%
General targets	-	2%	-3%
Technology specific targets	-	137%	-44%

For a full explanation of how to interpret the table and the visualisations see section 3.3.3. The visualisations show that Spain has undertaken significant projects in renewable energy, but has not fully met many of its targets. The gross final electricity consumption target is progressing well, but other targets are mostly close to being met, either falling just short or being achieved slightly later than planned.

Solar power is experiencing strong growth, reflecting a positive development trend. The future targets for renewable energy seem unlikely to be met unless substantial changes are made to the current development pace.

One area of concern is offshore wind, which is the furthest behind in terms of achieving its targets. While Spain has launched significant projects, this sector will need faster expansion to meet the ambitious future goals.

The table shows that the performance rate for general targets decreased from 2010-2015 to 2016-2024 for all targets. Technology specific targets went from being significantly overachieved 137%, mainly because of the underestimation of solar power, to instead being underachieved -44%, general targets follow the same trend, but is only slightly overachieved in the earlier time period and slightly underachieved in the later.

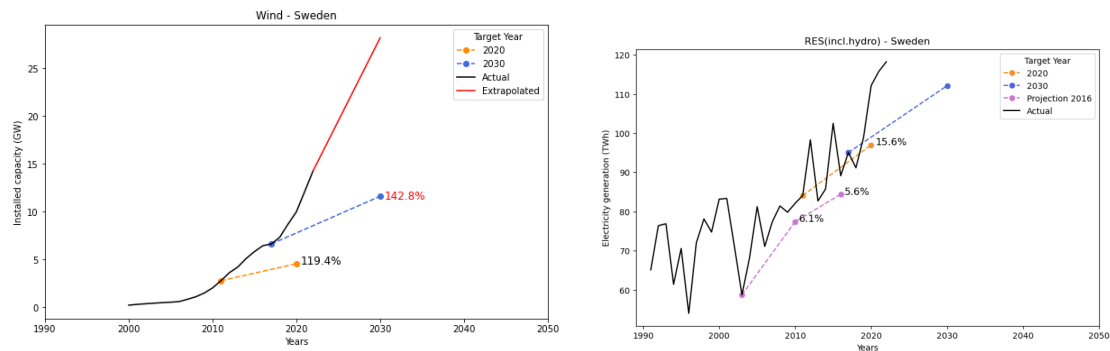
### 4.1.7 Sweden

In 2024 Sweden had a total of 162 TWh electricity generation, out of which 71.6% was from renewable energy sources (Kraftnät, 2025; Swedish Energy Agency, 2025). Hydropower dominates the Swedish electricity market with 39.5 %, followed by wind power with 25.5 %, biomass with 7.6 % and solar power with 1.5 % (Svenska kraftnät, 2025; Swedish Energy Agency, 2025).

As an effect of Sweden’s cold climate and long distances, energy supply has always been a crucial issue. The country has long relied on developing stable, domestic energy sources to meet the needs of both households and industry. One of the main reasons Sweden already had a significant amount of hydropower early on is due to its natural conditions: the country has many large rivers, high levels of precipitation in some areas, and considerable differences in elevation, especially in the northern parts (Vattenfall, 2024). These factors create ideal conditions for hydropower generation (Vattenfall, 2024).

In addition to hydropower, Sweden has favourable conditions for other renewable energy sources. The vast forests provide a strong basis for bioenergy, which is widely used for heating and electricity production (Swedish Energy Agency, 2024). Sweden’s long coastline and open landscapes also offer good potential for wind power, which has been expanding rapidly in recent years (Statkraft, 2024). The present Swedish energy mix is characterised by a high percentage of renewable energy alongside nuclear power, and the country continues to increase its use of renewables to reduce reliance on fossil fuels (Swedish Energy Agency, 2024).

Sweden has for a long time been taking action for climate change by expanding the installed capacity for renewable energy, for example, Sweden attended the Berlin Climate Change Conference in 1995, even though no specific targets were set (UNFCCC, 1995). Sweden’s first concrete renewable energy targets were introduced following the Kyoto Protocol. Swedish targets can be found as early as 1998, aimed to be achieved by 2010 (UNFCCC, 1997). It is also worth noting that Sweden is a member of the EU (European Union, n.d-a).



**Figure 4.14:** Visualisation of Sweden’s data.

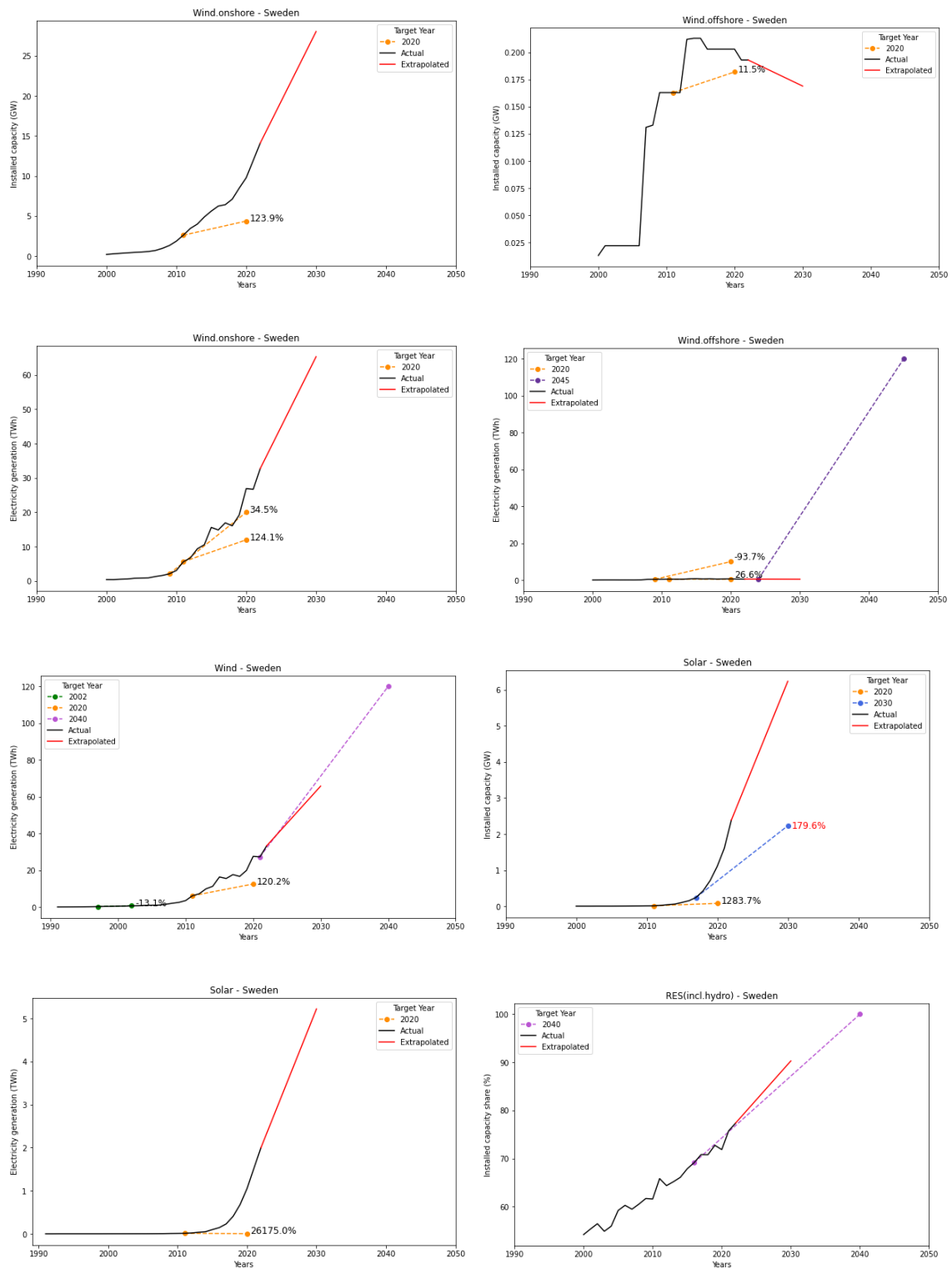
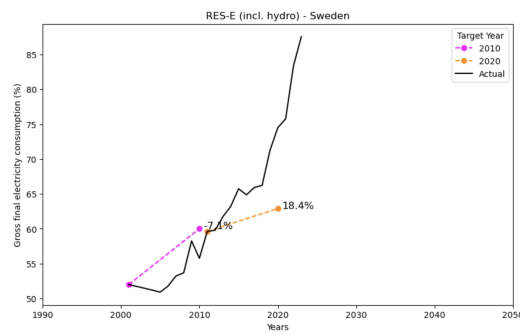


Figure 4.15: Continued visualisation of Sweden's data.

## 4. Results



**Figure 4.16:** Continued visualisation of Sweden’s data.

**Table 4.7:** Average performance for Sweden over the time periods: 1990-2009, 2010-2015 and 2016-2024, and for the categories: 'All targets', 'General targets', 'Technology specific targets'.

Category	1990–2009	2010–2015	2016–2024
All targets	-13%	0 %	23%
General targets	-	0%	2%
Technology specific targets	- 13%	-	36%

For a full explanation of how to interpret the table and the visualisations see section 3.3.3. The extent to which Sweden achieved its energy targets varies significantly between different technologies. For instance, the target for offshore wind electricity generation set in 2009 with a target year of 2020 was missed by a wide margin, with the actual outcome falling 93.7% below the goal. However, the target set in 2011 proved to be very close to the eventual results. In contrast, the outcomes for onshore wind align more closely with the initial targets. Looking at the installed capacity visualisations, it is clear that Sweden not only met but exceeded its targets for offshore wind, onshore wind, and their combined totals.

When it comes to solar power, Sweden far surpassed its goals for installed capacity, although it should be noted that the original targets were relatively modest.

It is worth noting that Sweden has set relatively few new targets since 2020, possibly because the country has already achieved many of its previous goals and possesses a substantial share of renewable energy.

Overall, Sweden exceeded its renewable electricity generation targets, although the actual production varied somewhat over time, as seen in the visualisation showing the share of electricity generation. Installed capacity trends also largely followed the target trajectory. Notably, the gross final energy consumption exceeded the set targets by a considerable margin. The table displays that Sweden has had a significant increase in performance over all three time periods. In the last time period for general targets, Sweden’s performance was almost exactly in line with the target

for both 2010-2015 and 2016-2024, but the country had a much higher performance rate for the technology specific in 2016-2024.

The visualisation of offshore wind indicates an ambitious target for 2045, which current extrapolated data does not appear to support. In contrast, Sweden has nearly reached its 2030 solar power target, suggesting the potential for setting even more ambitious goals in this area.

In general, Sweden achieved most of its targets. However, one thing to keep in mind is that Sweden historically has had a relatively high amount of renewable energy and has often surpassed EU targets prematurely (Service, 2024) leaving the country with more discretion in national target setting.

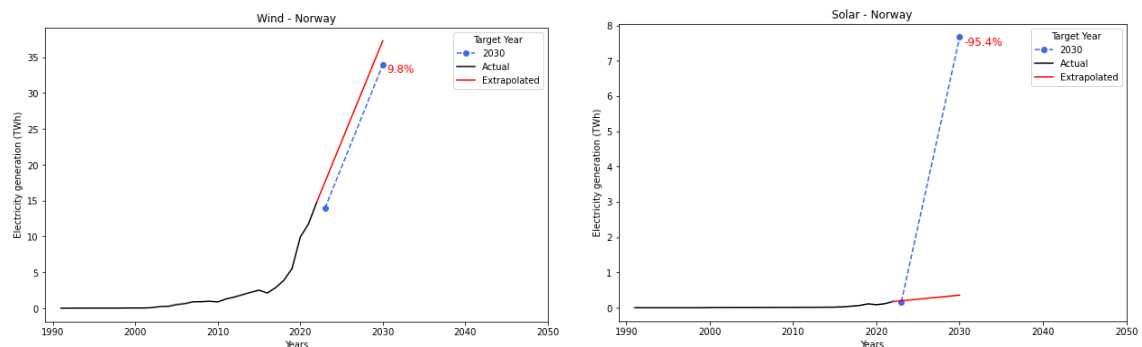
### 4.1.8 Norway

Norway is a country well known for having large supplies of oil and natural gas (Norsk Petroleum, 2025). However, most of the supply is exported. In 2022 Norway was the country in Europe that produced the most natural gas and crude oil but was also the country that exported the most of these two sources (International Energy Agency, n.d.-e). The export has created a good economic ground for Norway (Norsk Petroleum, 2025). However, in 2021 Norway was one of the top three countries with the most renewable energy sources in both energy consumption and electricity generation (International Energy Agency, n.d.-h).

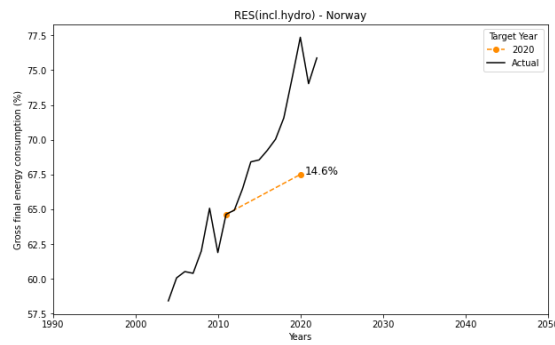
Norway's first hydroelectric power plant was built more than 100 years ago and thanks to the hydropower, Norway's industrial development was clean and mostly based on renewable energy sources (Norges Regjering, 2019). Today hydropower accounts for almost all of Norway's electricity production and is the sixth largest producer in the world (Norges Regjering, 2019). Norway's technology on hydropower is one of the foremost in the entire world and the technology is exported to other countries in order to help with transitions (Norges Regjering, 2019).

Norway is located in Europe but is not a member of the EU, however the country is a member of the EEA. Even though Norway is legally bound to some of the EU's directions, the country is more independent in their policies (López & Razauskas, 2024).

Norway is a country with 5.5 million inhabitants (Statistisk sentralbyrå, 2025), which means that it is the country with the second lowest population in this thesis. However, in 2021 Norway was the country that consumed the second most electricity per capita in the world. The electricity demand is expected to increase in the future and to meet this, wind power is expected to increase and quadruple to year 2050 (Liljegren, 2021).



**Figure 4.17:** Visualisation of Norway's data.



**Figure 4.18:** Continued visualisation of Norway’s data.

**Table 4.8:** Average performance for Norway over the time periods: 1990-2009, 2010-2015 and 2016-2024, and for the categories: 'All targets', 'General targets', 'Technology specific targets'.

Category	1990–2009	2010–2015	2016–2024
All targets	-	-	14%
General targets	-	-	14%
Technology specific targets	-	-	-

For a full explanation of how to interpret the table and the visualisations see section 3.3.3. The visualisations show that wind power has increased a lot in the last couple of years and is expected to increase even more. This could be because Norway already has a lot of hydropower and therefore needs to expand something else to still increase the share of renewables. However, Norway seems to overestimate its ability to meet their solar power target in 2030. Solar power is not a big electricity source in Norway, but according to the visualisations it seems to increase in the years forward. However, it seems as if Norway expects it to be easier to increase the amount of wind power, which could depend on the fact that the country is located relatively far north and has a long coastline.

The gross final energy consumption has according to the visualisations made a huge increase in percentage points from year 2010 to 2020 which could depend on the EU’s directive. As seen in the table, Norway has historically not set any technology specific targets, but the country has overachieved its general targets for 2016-2024.

### 4.1.9 Switzerland

Switzerland is an advanced economy located in the middle of Europe (Swiss Confederation, 2025). Since 1990, it has experienced substantial economic and population growth. Switzerland was also early with action to prevent climate change and has had targets to reduce greenhouse gas emissions since the 1990's. Since then the country has regularly updated their climate goals (Swiss Confederation, 2025). One thing to note is that Switzerland is a direct democracy, where three to four times a year the whole population votes on specific issues, where climate issues sometimes are among them (Swiss Confederation, 2023).

Switzerland has historically relied heavily on both hydropower and nuclear power (IEA, n.d). These reliable source of low-carbon energy have served to keep Switzerland as an advanced economy(Swiss Confederation, 2025). However, as new policy priorities arise, such as the discontinuing of new nuclear power, and economic growth demands more energy, other renewables will become more important to Switzerland in the future (World Nuclear Association, 2025). Today, hydropower and nuclear power together make up around 90% of Switzerland's total electricity generation, where hydropower is responsible for around 55% and nuclear power around 35%. This generation has remained relatively stable since the year 2000, with recent growth coming from new initiatives in solar and wind power (IEA, n.d).

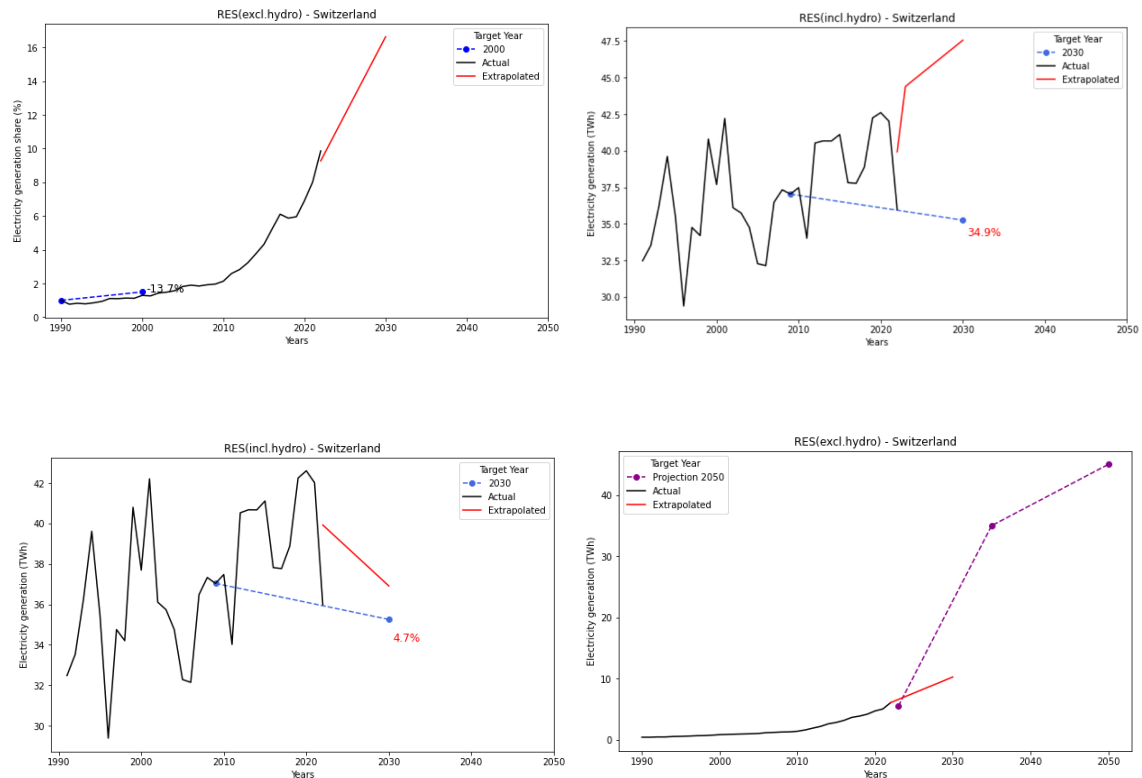


Figure 4.19: Visualisation of Switzerland's data.

**Table 4.9:** Average performance for Switzerland over the time periods: 1990-2009, 2010-2015 and 2016-2024, and for the categories: 'All targets', 'General targets', 'Technology specific targets'.

Category	1990–2009	2010–2015	2016–2024
All targets	-14%	-	-
General targets	-14%	-	-
Technology specific targets	-	-	-

For a full explanation of how to interpret the table and the visualisations see section 3.3.3. Switzerland, compared to many other countries, started its target setting early, with the earliest targets from the 1990s. Historically, it has a relatively high performance, at most underachieving a target with 14%. This despite its electricity generation fluctuation, which is mainly caused by the influence of hydropower. This can be seen as the targets excluding hydropower do not have the same fluctuations as the ones including it.

A general trend of rising electricity generation is visible across all visualisations. Renewable energy generation, including hydropower, appears likely to exceed its intended targets; however, it is worth noting that the targeted amount was already lower than the existing generation level at the time the goal was set. It is also notable that renewable energy generation excluding hydropower is increasing, corresponding to the policy changes mentioned above.

The table shows an underachievement in 1990-2009, but other than that, no patterns can be observed. This is because of the lack of targets for remaining time periods.

### 4.1.10 Philippines

The Philippines is an island nation in Southeast Asia. It has a population of 113 million people and is a major economy in the region (Hernandez & Borlaza, 2025). The Philippines is a member of ASEAN (Association of Southeast Asian Nations, n.d).

Its economy is mainly dependent on services but the country also has a major manufacturing complex focused on electronics and textiles (Hernandez & Borlaza, 2025). This large and growing manufacturing complex together with a push to get people out of poverty will require more energy in the future (Gonzales, 2024).

The Philippines has a history of heavy reliance on fossil fuels. As for renewable energy sources, the Philippines has mainly geothermal and hydropower as its two major energy sources (Ember, 2025b). This still holds true today, but recently a new initiative focusing on renewables such as solar and wind has been growing in the country (Foreign, Commonwealth Development Office, 2024).

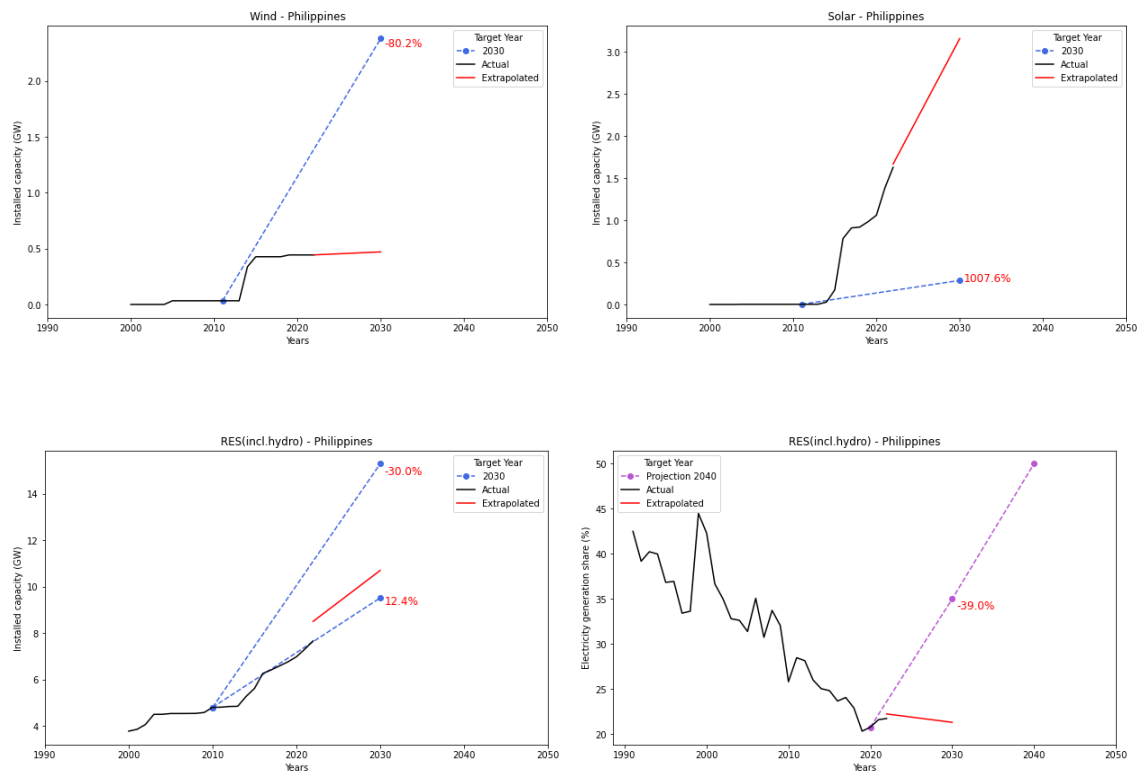


Figure 4.20: Visualisation of the Philippines' data.

**Table 4.10:** Average performance for the Philippines over the time periods: 1990-2009, 2010-2015 and 2016-2024, and for the categories: 'All targets', 'General targets' and 'Technology specific targets'.

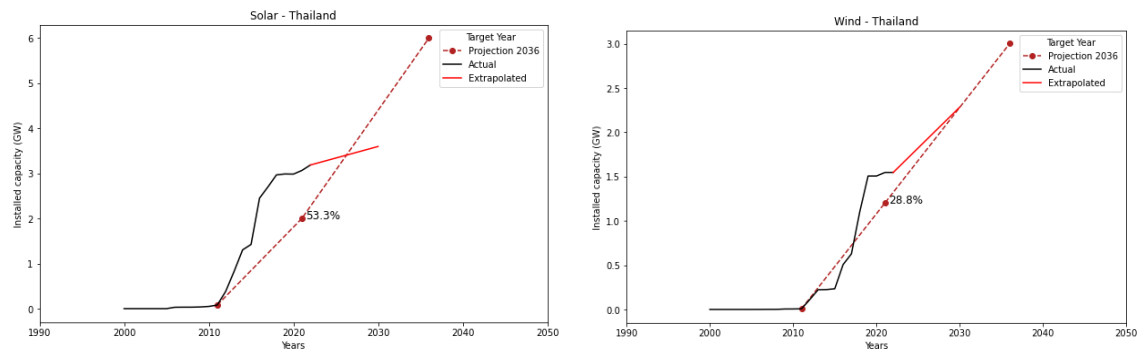
Category	1990–2009	2010–2015	2016–2024
All targets	-	-	-
General targets	-	-	-
Technology specific targets	-	-	-

For a full explanation of how to interpret the table and the visualisations see section 3.3.3. As can be seen from the visualisations, all of the Philippines' targets are set beyond the year 2025, making it difficult to assess their past performance. This also renders the table comparing different time periods redundant. However, using extrapolated data, some observations can still be made. Overall, the Philippines' targets regarding exact values appear to perform better than its share-based targets. Although there is an underachievement in wind power, the significant overachievement in solar power more than compensates for this. Regarding their RES including hydro, it seems on track to achieve the less ambitious goal by 2030. One notable observation is the decrease in the electricity generation share coinciding with an increase in overall renewable capacity. This suggests that total electricity generation has increased more rapidly than renewable electricity generation, leading to a smaller overall share of renewable electricity in the country.

### 4.1.11 Thailand

Thailand is a part of ASEAN (Association of Southeast Asian Nations, n.d), and its main energy sources are oil and natural gas (International Energy Agency, n.d-a). In the electricity section, natural gas and coal are the largest sources (International Energy Agency, n.d-e). Since the year 2000, the electricity generation has increased by almost 100%. Even though the production has increased considerably, in 2022 Thailand was the country in the Asia-Pacific region that imported the most electricity (International Energy Agency, n.d-e).

Although Thailand primarily relies on fossil fuels for its energy and electricity needs, the country aims to achieve carbon neutrality by 2050 (International Trade Administration, 20234). To achieve this, its energy policies need to change, and its dependency on natural gas needs to decrease (International Energy Agency, n.d-c). The share of renewable energy sources has increased in the last decade but in order to achieve the national targets it would need to increase even more. The energy demand is expected to increase by several percentage points in the future and the country therefore needs to prepare and scale up the renewable energy sources. Solar power and wind power seem to have great potential, but the country is also investigating other renewable options (IRENA, 2017).



**Figure 4.21:** Visualisation of Thailand’s data.

**Table 4.11:** Average performance for Thailand over the time periods: 1990-2009, 2010-2015 and 2016-2024, and for the categories: 'All targets', 'General targets', 'Technology specific targets'.

Category	1990–2009	2010–2015	2016–2024
All targets	-	-	41%
General targets	-	-	-
Technology specific targets	-	-	41%

For a full explanation of how to interpret the table and the visualisations see section 3.3.3. The visualisations shows that Thailand does not have a high amount of

renewable energy sources. Solar power is almost twice as large as wind power. Until the year of 2020 both the solar- and wind power targets were met with good margin but after that the visualisations shows that the solar power target will not be met, but the wind power will in the future.

As the table shows, Thailand's performance was overachieved with several percentage points. This is because of the increase in both solar and wind power starting in 2011 when the targets were introduced.

### 4.1.12 Vietnam

Vietnam has been a part of ASEAN since 1995 (Association of Southeast Asian Nations, n.d.). The total electricity generation in the country in 2022 was 276.416 TWh, of which 49.1% came from renewable energy sources. This nearly 50% share consists of the following shares of non-combustible renewable energy sources: 71.9% hydropower, 6.8% wind power and 21.3% solar PV (International Energy Agency, n.d.-i). While the share of hydropower is quite high, hydropower sources are almost exhausted. However, there is still much potential for solar and wind sources (Ha et al., 2024). When considering Vietnamese policies and targets, it is also important to remember that there are things hindering the low-carbon transition in the country. Vietnam has a solid foundation for the transition because it has established policies, but there are examples of barriers and gaps within the transition. Among them, political structure, minimal regulations for renewable energy development, and what information and awareness there is about the situation of the country (Shem et al., 2019).

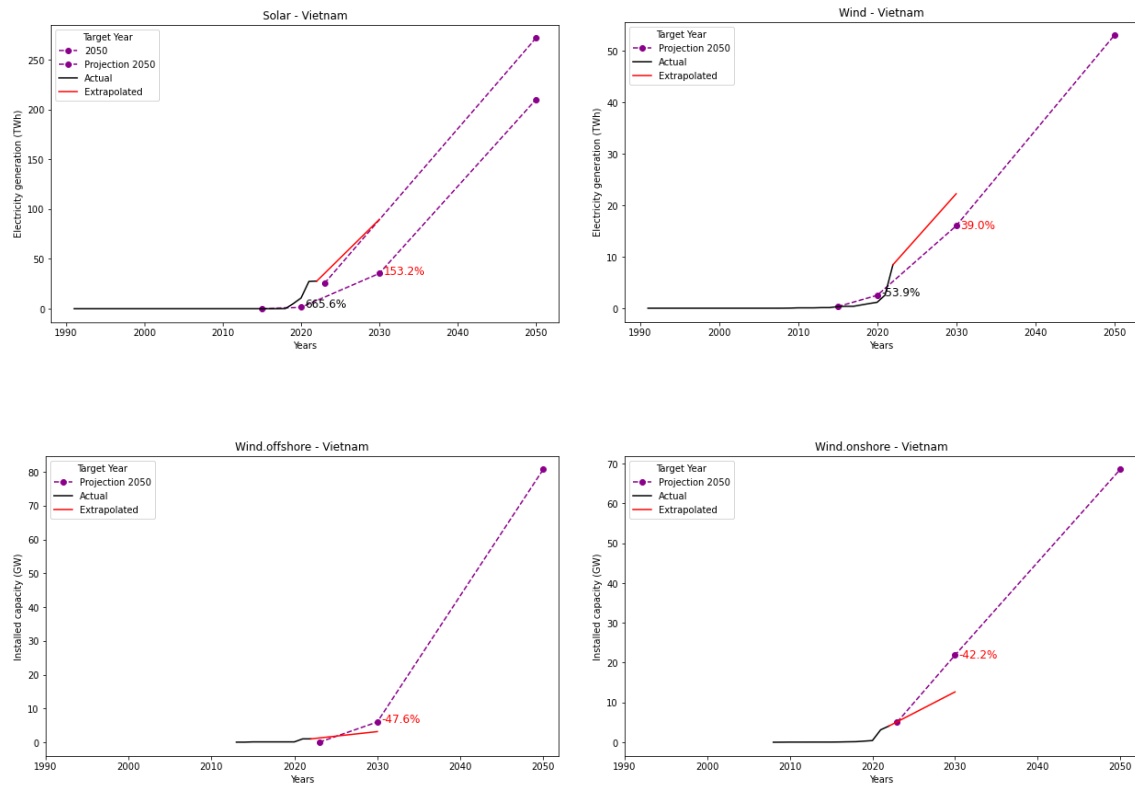
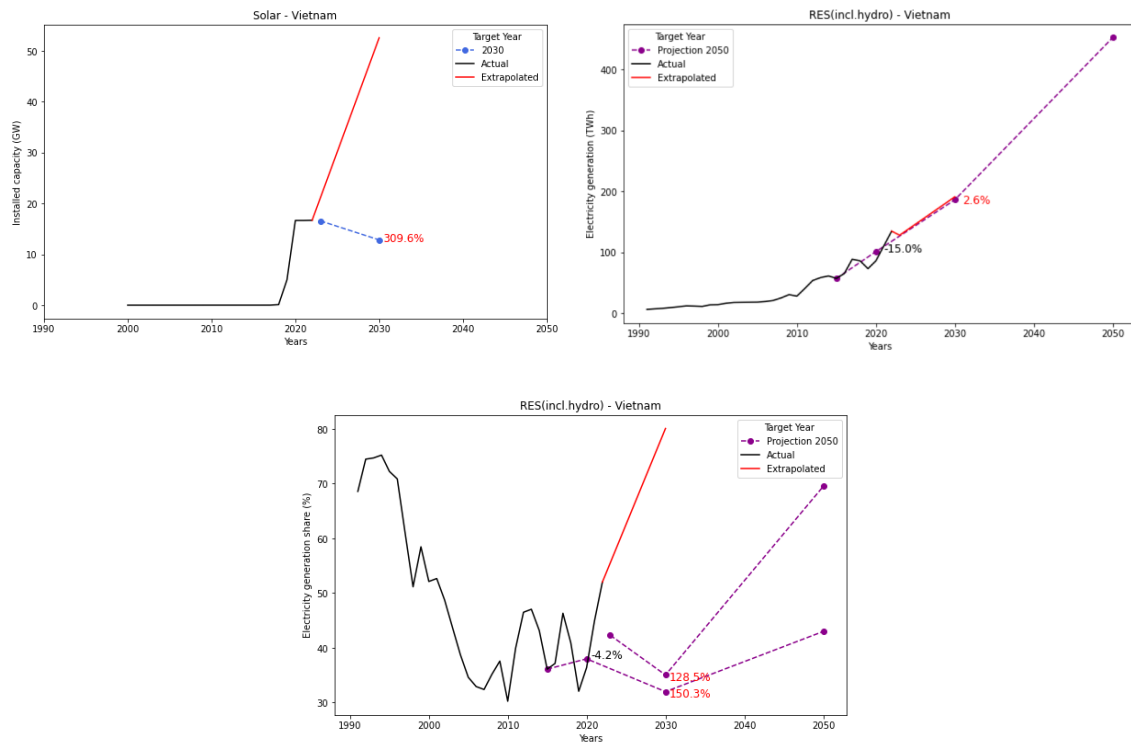


Figure 4.22: Visualisation of Vietnam’s data.



**Figure 4.23:** Continued visualisation of Vietnam's data.

**Table 4.12:** Average performance for Vietnam over the time periods: 1990-2009, 2010-2015 and 2016-2024, and for the categories: 'All targets', 'General targets', 'Technology specific targets'.

Category	1990–2009	2010–2015	2016–2024
All targets	-	-	148%
General targets	-	-	-9%
Technology specific targets	-	-	305%

For a full explanation of how to interpret the table and the visualisations see section 3.3.3. Observing the visualisation of Vietnam's data there are a few things to point out. Firstly, the actual data shows how the use of both wind and solar sources only began increasing in recent years. Because of this it is quite difficult to make out any progress patterns other than that some increase has happened within the actual data. Secondly, the visualisations of the technology specific targets show quite ambitious targets while the extrapolated data shows slightly different expectations for the future actual data that might not align with those targets. In addition, there are no targets set further back meaning not many targets exist where a historical performance can be computed. These factors make it difficult to understand how well Vietnam is currently performing, what their progress is and how their achievement may look in the future.

Furthermore, looking into the visualisations with RES sources some different patterns are visible. The amount of RES sources used seems to have varied more historically than technology specific sources, and there also seems to exist older targets for the RES sources. The electricity generation visualisation seems to imply that Vietnam is currently on a trajectory where they are somewhat achieving their targets and making steady progress. On the other hand the electricity generation share plot shows many variations throughout the last decades which makes it harder to evaluate their performance and progress.

Finally, table 4.12 shows that there is no available data for performance over the first two time periods of the study. However, in the third time period there is a lot of overachievement, especially in the case of technology specific targets. Although this could be caused by an underestimation of how applicable solar power would be. Altogether, the table does not show much of Vietnam's performance over all the time periods, but shows that in recent years progress is beginning to happen.

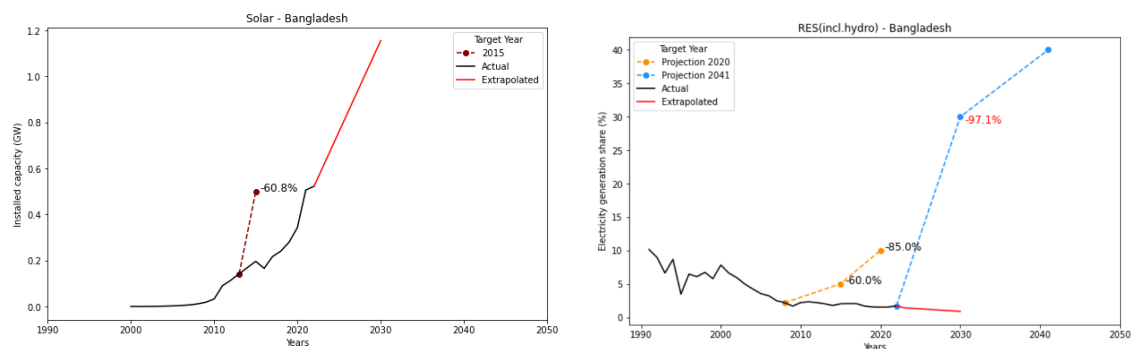
### 4.1.13 Bangladesh

Bangladesh is one of the most densely populated countries in the world with approximately 1300 people per square kilometre as of 2022 (World Bank Group, 2022). Bangladesh has a growing economy and increasing energy demand (World Bank Group, 2024). Bangladesh is also one of the most exposed and vulnerable countries to climate change in the world. High risks of floods, rising sea levels, droughts, and increasing ambient temperatures pose serious threats to the national electricity grid and can hinder the expansion of renewable energy (Khan et al., 2013).

As of 2022, renewable energy sources accounted for only 1.6% of the total electricity generation (International Energy Agency, 2022a). Traditionally, the country has relied heavily on natural gas and other fossil fuels, but over the past two decades, it has begun to invest more in renewable energy, particularly solar power (International Energy Agency, 2022a).

The country's investment in solar power has mainly focused on off-grid solar home systems in remote rural areas where the national power grid does not reach (World Bank Group, 2021). The major push for solar power began in the early 2000s. Millions of rural households gained access to electricity through small solar panels. This initiative has received international recognition as a successful model for implementation of renewable energy in developing countries (World Bank Group, 2021).

In contrast, hydropower contributes the least to the energy mix, due to Bangladesh's flat geography and lack of large elevation changes, which makes large-scale hydroelectric plants infeasible. However, there is potential for smaller, river-based hydropower projects (Salehin, 2024).



**Figure 4.24:** Visualisation of Bangladesh's data.

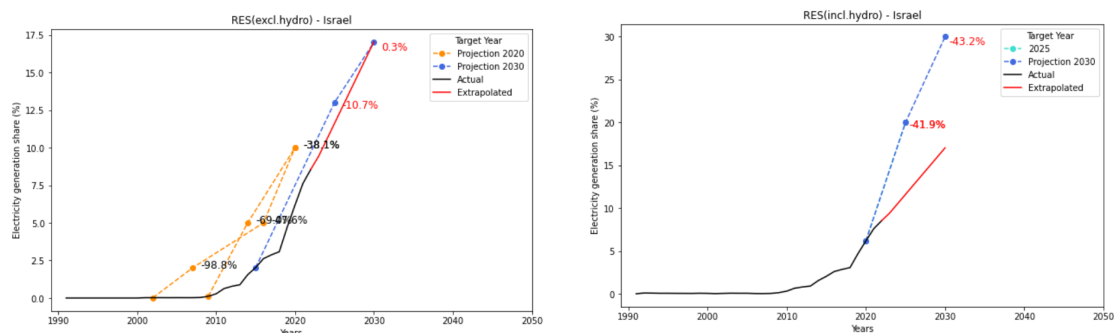
**Table 4.13:** Average performance for Bangladesh over the time periods: 1990-2009, 2010-2015 and 2016-2024, and for the categories: 'All targets', 'General targets', 'Technology specific targets'.

Category	1990–2009	2010–2015	2016–2024
All targets	-	-60%	-85%
General targets	-	-60%	-85%
Technology specific targets	-	-60%	-

For a full explanation of how to interpret the table and the visualisations see section 3.3.3. The 2015 target for solar power was not met, however, as shown in the visualisation above, the expansion in solar power was still significant and the target was met a few years later. The country generally faces challenges in achieving its energy goals. None of the previous national targets for renewable electricity generation share has successfully been met. The visualisations show that the share of renewables has recently declined, as fossil fuel-based energy production has expanded. The performance rate has decreased in the latest time period compared to 2010-2015 as seen in the table. Bangladesh has set relatively ambitious targets for 2030 and 2040, but at the current pace, these seem unlikely to be met unless significant changes are made in energy policy and infrastructure development.

#### 4.1.14 Israel

Israel is a small and densely populated country that is characterised by both a growing economy and population (ClimateWatch, 2021). Its electricity has historically been dependent on fossil fuels due to a lack of access to a shared power grid on account of its political situation. At the same time, Israel lacks common low-carbon options such as hydropower, nuclear power or geothermal power (ClimateWatch, 2021). As a consequence of competing interests for land use, large-scale energy infrastructure is difficult to complete. As a result, Israel's current renewable energy generation comes mostly from solar power, with ongoing initiatives aimed at expanding this capacity in the future (ClimateWatch, 2021).



**Figure 4.25:** Visualisation of Israel's data.

**Table 4.14:** Average performance for Israel over the time periods: 1990-2009, 2010-2015 and 2016-2024, and for the categories: 'All targets', 'General targets', 'Technology specific targets'.

Category	1990–2009	2010–2015	2016–2024
All targets	-98%	-69%	-41%
General targets	-98%	-69%	-41%
Technology specific targets	-	-	-

For a full explanation of how to interpret the table and the visualisations see section 3.3.3. As the visualisations above show, Israel tracks its targets relatively well, although with a delay of a few years after the intended deadlines. Of the two graphs, the one showing RES excluding hydropower more closely follows the target. This suggests that non-hydropower sources, primarily solar power in Israel's case, perform better than the overall general target. Several factors could explain this, but one likely contributor is the ongoing initiatives in solar power. One notable trend is that Israel's performance score improves over time, starting at -98% in the first time period and reaching -41% by the third.

### 4.1.15 Pakistan

Pakistan is a country with a rapidly growing economy and population located in South Asia. As the fifth most populous country in the world, its economy has developed into a major manufacturer (Worldometer, 2025). To fuel its manufacturing industry and increasing population, the energy sector has been rapidly expanding (Burki & Ziring, 2025).

Pakistan has historically been heavily dependent on fossil fuels. With ever-increasing investments to expand energy supply through fossil fuels since the 1980s, Pakistan’s share of total energy generation reliant on fossil fuels peaked in 2007 at 62% (Macrotrends, 2025). Since then, the share of fossil fuels used for energy has remained around 60% (Macrotrends, 2025).

Of its renewable energy generation, hydropower has by far been the largest source and has had a steady 30% of its total generation up until the mid-2010s (Ember, 2025a). At this time, a large increase in electricity generation introduced renewable energy sources such as wind and solar power, but also caused a significant increase in coal power, keeping the total share of fossil fuels relatively stable (Ember, 2025a).

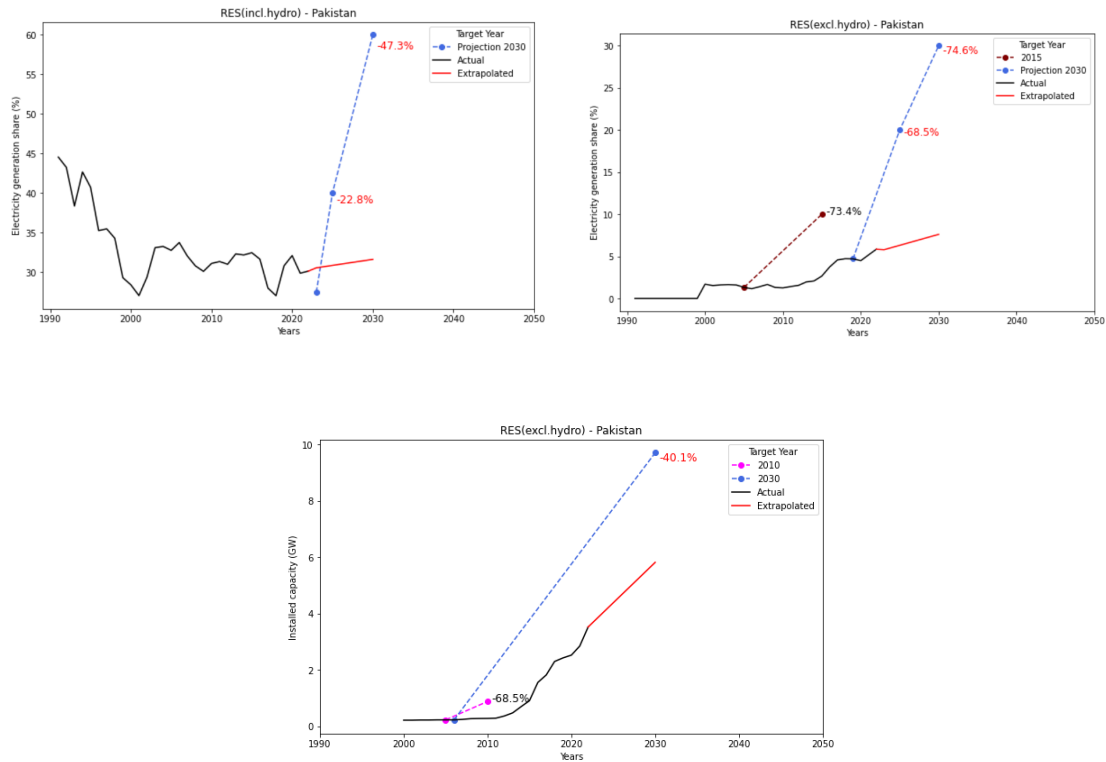


Figure 4.26: Visualisation of Pakistan’s data.

**Table 4.15:** Average performance for Pakistan over the time periods: 1990-2009, 2010-2015 and 2016-2024, and for the categories: 'All targets', 'General targets', 'Technology specific targets'.

Category	1990–2009	2010–2015	2016–2024
All targets	-	-70%	-
General targets	-	-70%	-
Technology specific targets	-	-	-

For a full explanation of how to interpret the table and the visualisations see section 3.3.3. As the visualisation shows, most of Pakistan's goals appear overambitious. One notable trend is that RES excluding hydropower is increasing and demonstrates higher performance compared to RES including hydropower. This may indicate that other renewable sources, apart from hydropower, and total electricity generation have increased over time. As a result, the relatively stagnant hydropower generation has dragged down the average performance for RES including hydropower. This seems supported by the steady increase in installed capacity over time.

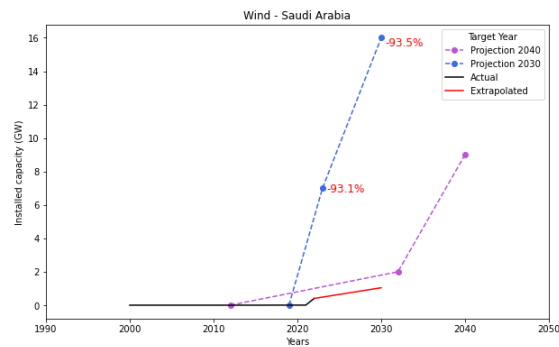
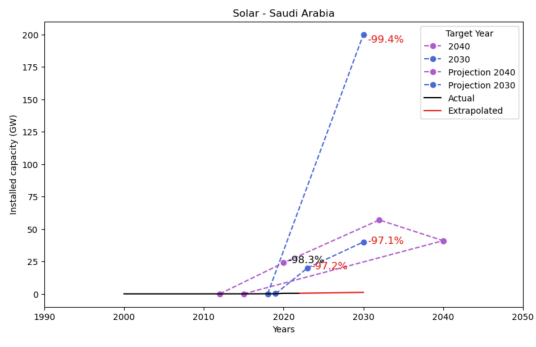
The visualisations show that most targets were either set in the early 2000s with a targeted completion date in the late 2010s or were set more recently, with deadlines around 2030. As a result, the table only covers one time period, making it difficult to draw conclusions about the performance over time.

### 4.1.16 Saudi Arabia

Saudi Arabia is heavily dependent on fossil fuels, with data from 2022 showing that oil and natural gas account for 64.2% and 35.7% of the country’s energy production, respectively, while renewable energy contributes only 0.1% to their energy supply (International Energy Agency, n.d-b). In terms of electricity generation, the data shows little variation, with fossil fuels still providing the largest share and wind accounting for only 0.4% (International Energy Agency, n.d-b).

Being situated in the Middle East, Saudi Arabia has a desert climate, which means high temperatures and very long dry periods (Rajesh, 2020). With up to 3300 hours of sunshine annually, and wind velocity reaching a high level in some parts of the country, Saudi Arabia has a strong foundation for harnessing energy from both solar and wind (PV KnowHow, 2025). Saudi Arabia also possesses 17% of the world’s oil reserves and serves as the backbone of the Saudi Arabian economy (World Finance, 2023).

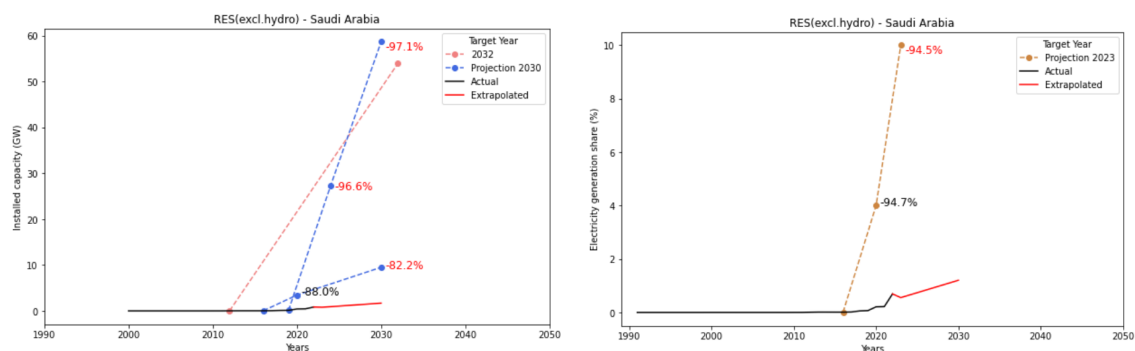
Saudi Arabia has recently begun targeting renewable energy, with goals extending to 2030 for most technologies, except hydropower, due to the country’s desert climate (Jingsun, 2024). For example, the country is home to the largest wind farm in the Middle East, with an installed capacity of 400 MW. In addition, plans are underway for the region’s largest solar plant, projected to reach an installed capacity of 1100 MW, in alignment with the Vision 2030 initiative (EDF, 2025).



(a) See footnote <sup>10</sup>.

**Figure 4.27:** Visualisation of Saudi Arabia’s data.

<sup>10</sup>The purple line in this figure visualises the same target being adjusted a few years later to a smaller target



**Figure 4.28:** Continued visualisation of Saudi Arabia’s data.

**Table 4.16:** Average performance for Saudi Arabia over the time periods: 1990-2009, 2010-2015 and 2016-2024, and for the categories: 'All targets', 'General targets', 'Technology specific targets'.

Category	1990–2009	2010–2015	2016–2024
All targets	-	-	-95%
General targets	-	-	-93%
Technology specific targets	-	-	-97%

For a full explanation of how to interpret the table and the visualisations see section 3.3.3. In the visualisations above it is clear that Saudi Arabia underperformed relative the established targets. Looking at the actual data, there are signs that the trend is beginning to shift, for example the visualisation of the wind shows a slight increase in installed capacity. One can also tell that Saudi Arabia have set more goals for solar than any other renewable energy source. In the table of the performance rates it can be seen that Saudi Arabia almost failed in all of the categories with about 100%. This may be the result of Saudi Arabia being very dependent on fossil fuels as an energy source as well as a source of income.

### 4.1.17 Taiwan

From the 1960s the energy mix of Taiwan has been dominated by fossil fuels and it still is up until this present day with 78.3% from fossil fuels and 11.9% from renewable energy sources with a total power production of 251.44 TWh (Taiwan Power Company, 2025). This is an effect of the industrialisation in Taiwan after World War 2, where the manufacturing grew exponentially across the country because of U.S aid and the government investing in the market (Kawakubo, 2021).

Taiwan is an island nation situated in the Pacific right next to China and above the Philippines (Britannica, 2025), which provides favourable conditions for wind power installation. However, Taiwan faces environmental challenges such as typhoons and monsoons that create unfavourable conditions for construction (Open Access Government, 2023). Depending on the region there is a lot of sunshine, which is of course fitting for solar power. The annual sun hours range from 1,316.9 to 2,281.8, varying between the region of Keelung in the north (Keelung City Government, 2021), and Kaohsiung in the south of Taiwan (CWA, 2021; Taiwan Tourism Administration, n.d).

The ministry of energy and economics affairs in Taiwan announced plans in 2009 for the future production of energy where Taiwan aimed to increase its production of renewable energy under the policy "New Energy Policy Framework" (Ministry of Foreign Affairs, Republic of China (Taiwan), 2015). That document includes descriptions of further development of the following energy sources; wind (including offshore and onshore wind power), hydropower, solar PV, geothermal energy, biogas, waste to energy, ocean energy and H2& fuel cells (Climate Change Administration, Taiwan, 2025). Afterwards, there have been several announcements from the ministry about future energy plans. In 2021, a major plan called the Net-zero transition was published for future energy supply, stretching to 2050 (Climate Change Administration, Taiwan, 2025).

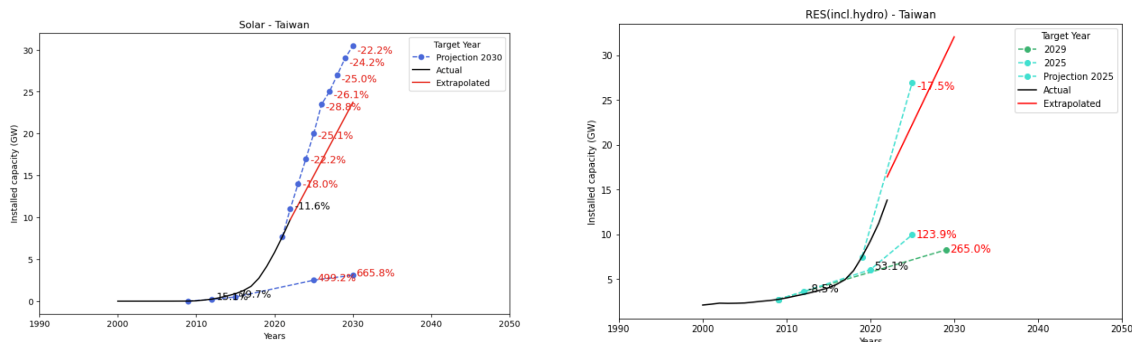
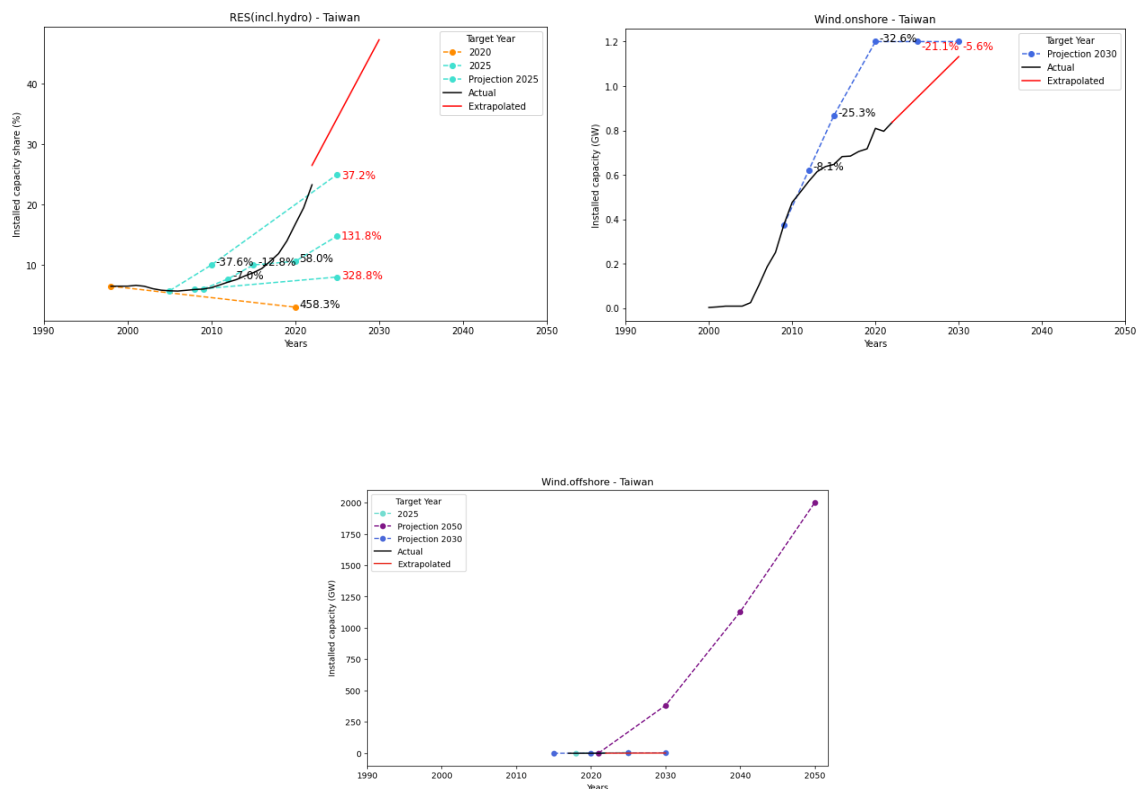


Figure 4.29: Visualisation of Taiwan's data.



(a) See the footnote <sup>11</sup>

**Figure 4.31:** Continued visualisation of Taiwan's data.

**Table 4.17:** Average performance for Taiwan over the time periods: 1990-2009, 2010-2015 and 2016-2024, and for the categories: 'All targets', 'General targets', 'Technology specific targets'.

Category	1990–2009	2010–2015	2016–2024
All targets	-	-11%	74%
General targets	-	-15%	189%
Technology specific targets	-	-7%	-40%

For a full explanation of how to interpret the table and the visualisations see section 3.3.3. From the results of the visualisations, it is clear that Taiwan has set some very ambitious goals. For example, the offshore wind target of 25 GW by 2025, set in 2019, which the country is currently falling short of by 78.7%. However, according to the projected data, Taiwan is expected to meet the targets set in 2009, but not the more recent targets set for 2019–2030. As for onshore wind, Taiwan initially met their targets up until around 2013, after which the actual data began to fall behind the targets. Based on the projected trends, the country is not expected to

<sup>11</sup>The performance rate presented in the caption of Taiwan's offshore wind (blue); 2020: -78.7%, 2025: -31.7%, 2030: -32.1%. (green line); 2025: -77.7%, (purple); 2025: -50.9%, 2030: -99.5%

meet their 2030 goal for onshore wind either. This might be because, as mentioned earlier, Taiwan is still heavily dependent on fossil fuels, and the targets were quite ambitious considering the fact that the starting point was zero. Taiwan might have planned for that much wind power because of their geographical prerequisites.

However, for solar power, one can tell from the visualisation that Taiwan already achieved some of their goals set for 2030 before 2020. However, these targets were much lower in comparison to the targets for, for example, offshore wind, making them easier to achieve. After that, Taiwan has set goals that gradually incline every year, and according to the extrapolated data it seems as if those targets might not be achieved.

For the overall targets for renewable energy in installed capacity, the curve quickly started to exceed the early targets, and therefore a higher target was set. But for the installed capacity share there was a slow start that later has exponentially increased and according to the extrapolated data one can tell that the level of increase is going to slow down.

The table of the performance rate shows that Taiwan had a higher rate of reaching their general targets than their technology specific ones. That can be because their scores for wind are very low and sources that we do not investigate specifically are included in the general targets.

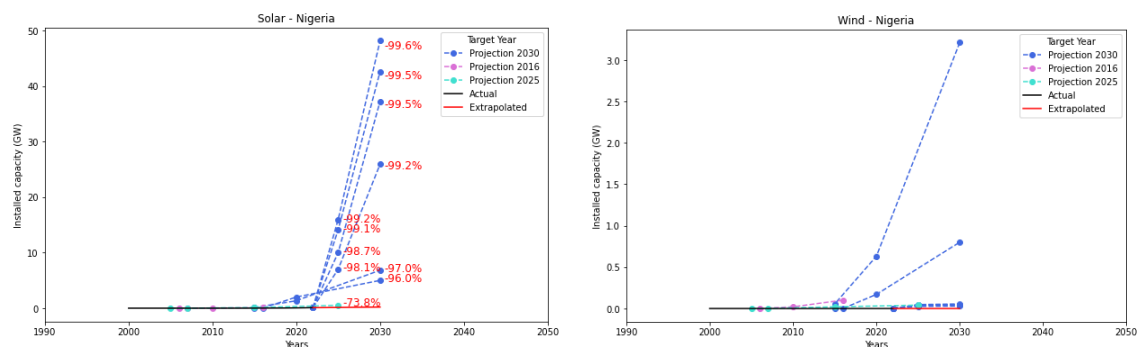
In conclusion, Taiwan has long relied on high-carbon energy sources throughout its time as an industrialised country, but in recent years it has begun to develop a more sustainable energy sector.

### 4.1.18 Nigeria

Nigeria is one of the largest economies in Africa (International Energy Agency, n.d.-d) and its economy has grown significantly within the studied time period for this project. In 1990 Nigeria's GDP was 54.04 billion US\$ and since then, it has increased to 363.85 billion US\$ in 2023 (World Bank Group, n.d.).

In 2022 Nigeria produced 37.915 TWh of electricity, of which 24.5% was made up of renewables. Most of those renewables consist of hydropower, as well as a much smaller share of solar PV. Out of the renewable electricity generation from non-combustible sources, about 98.9% is made up of hydropower and 1.1% of solar PV (International Energy Agency, n.d.-d). Hydropower has been used in the country for quite some time, which is shown by the fact that three hydropower stations were completed or commissioned between 1968 and 1990 (Kehinde et al., 2018). When it comes to both bio and wind sources, their share of electricity production in 2022 was 0% (International Renewable Energy Agency, 2024a).

Nigeria has a generally low corruption index (Transparency International, n.d). This may affect the country's ability to establish effective policy and accelerate national energy transitions.



(a) See the footnote <sup>12</sup>.

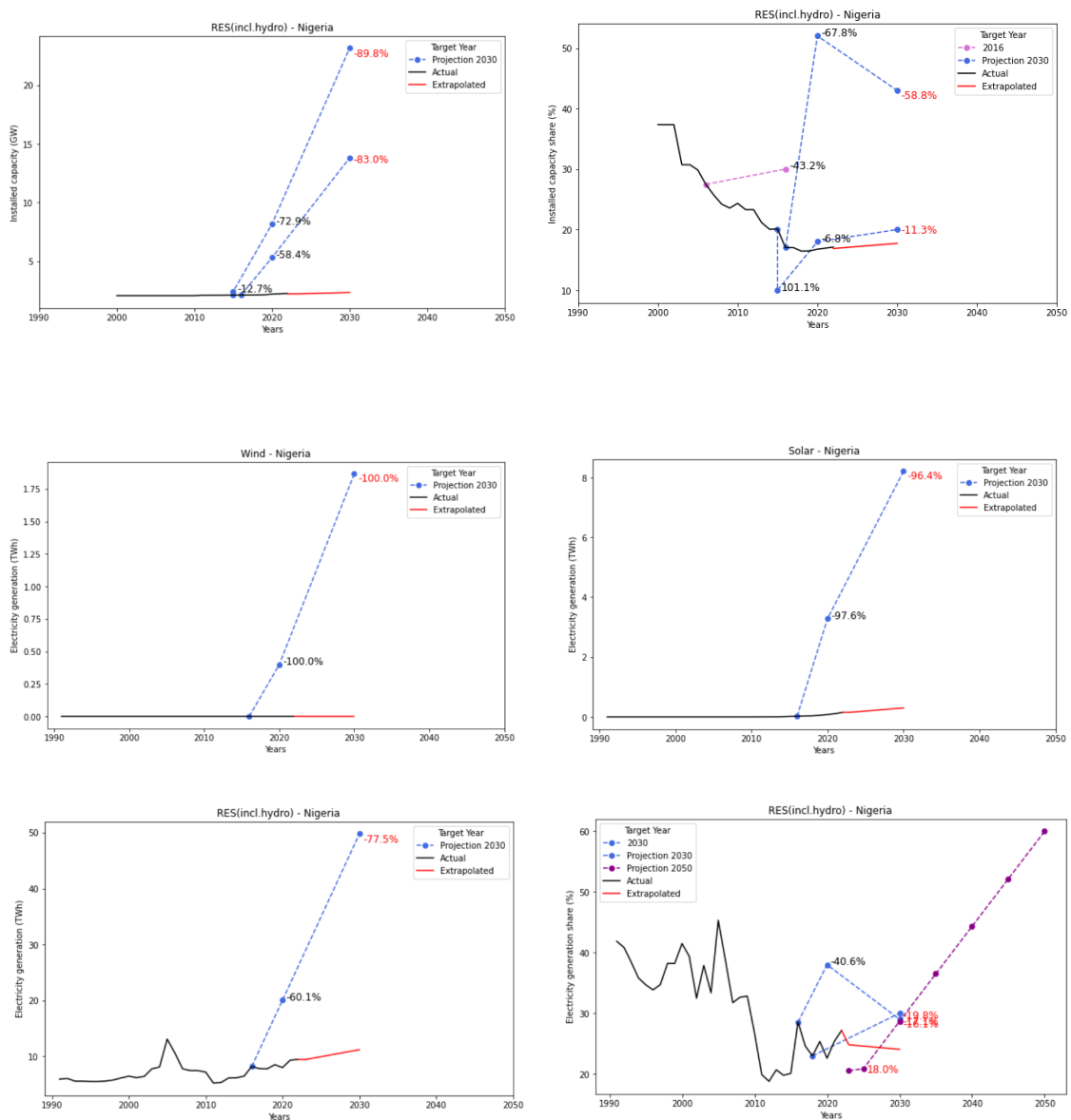
(b) See the footnote <sup>13</sup>.

**Figure 4.32:** Visualisation of Nigeria's data.

<sup>12</sup>For this visualisation on this page the calculated performance for Nigeria's targets before 2022 were excluded to give better visualisation. These values will be given here instead. Nigeria's projection for 2030 had the following accuracies for the following years: -90.9% in 2015, and -96.1% and -97.4% for the two scenarios in 2020. Regarding the projection for 2025 the following values were given: -98.4% in 2007 and -91.2% in 2015. Then, for the projection for 2016: -99.2% in 2007, -98.5% in 2010 and -88.7% in 2016.

<sup>13</sup>For this visualisation on this page all calculated performance values, both historical and future ones, were excluded to give better visualisation. All of the excluded performance values had an underachievement of -100%.

## 4. Results



**Figure 4.34:** Continued visualisation of Nigeria’s data.

**Table 4.18:** Average performance for Nigeria over the time periods: 1990-2009, 2010-2015 and 2016-2024, and for the categories: 'All targets', 'General targets', 'Technology specific targets'.

Category	1990–2009	2010–2015	2016–2024
All targets	-99%	-61%	-75%
General targets	-	44%	-49%
Technology specific targets	-99%	-96%	-97%

For a full explanation of how to interpret the table and the visualisations see section 3.3.3. When observing the visualisations of Nigeria’s targets there is a clear pat-

tern showing that quite a few targets are set, but then not realised and no progress is made. For the solar and wind sources the plots show several targets being set around the years 2010 and 2020 with a target year of around 2030. However, many of those targets are severely underachieved. Since the specific technology sources chosen to study further were solar and wind, it is important to note that since those sources make up very little of Nigeria's renewable electricity generation the results regarding those technologies may not be representative of Nigeria's achievement of targets in general. Therefore those results should probably not be generalised or made to symbolise Nigeria's performance in target setting as a whole.

When moving on to the RES targets that include hydropower somewhat different patterns are shown. When it comes to electricity generation it appears that the numbers for electricity production from RES sources were higher historically and have since then declined. Nevertheless, the targets set are quite ambitious and were not as underachieved as those for solar and wind. When comparing the future targets with the extrapolated data it appears that those targets might not be as underachieved as previously observed either. The targets for installed capacity follow almost the same pattern, with the difference being less variations historically in the actual data. For these reasons it can be said that for the RES targets some progress is made, since the underachievement is not as high as before and is expected to decrease in the future.

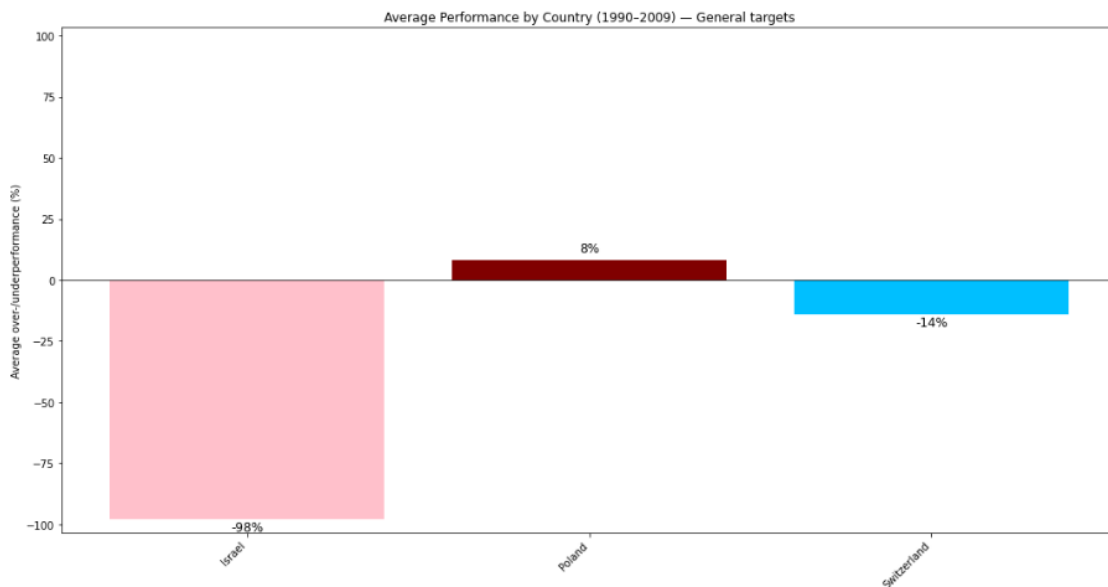
These same patterns of a general decrease of underachievement over time are also somewhat reflected in table 4.18, at least for the second time period. There the underachievement decreases because general targets are significantly overachieved. However, in the third time period there are increases in underachievement in all categories, contradicting the observed pattern.

## 4.2 Performance and comparison of countries

To conclude this chapter, visualisations of how much the countries over- and under-achieved their targets are presented. Countries without targets set before 2022 are not included in the analysis, as there is no available data to compare their performance with. The number of targets varies over the years and one country can be represented in the first visualisation, but is not necessarily represented in the visualisations for the years afterwards since it might not have targets for that time period. If the country has performed in line with its target, it will show a performance of 0% in the visualisations. A negative outcome indicates an underachievement and a positive outcome indicates an overachievement of the target. The visualisation of the general targets represents targets for all renewable energy sources, RES and RES-E, both including and excluding hydropower, depending on the country. Technology specific targets include specific targets for solar power and wind power, including both onshore and offshore wind. The visualisations with all of the targets show the performance of all targets, with the previous categories put together.

The following section presents nine visualisations, divided into the three named categories and further split across three time periods: 1990–2009, 2010–2015, and 2016–2024.

### Performance rate of the targets for 1990 - 2009



**Figure 4.35:** Achievement of general targets for the years 1990-2009.

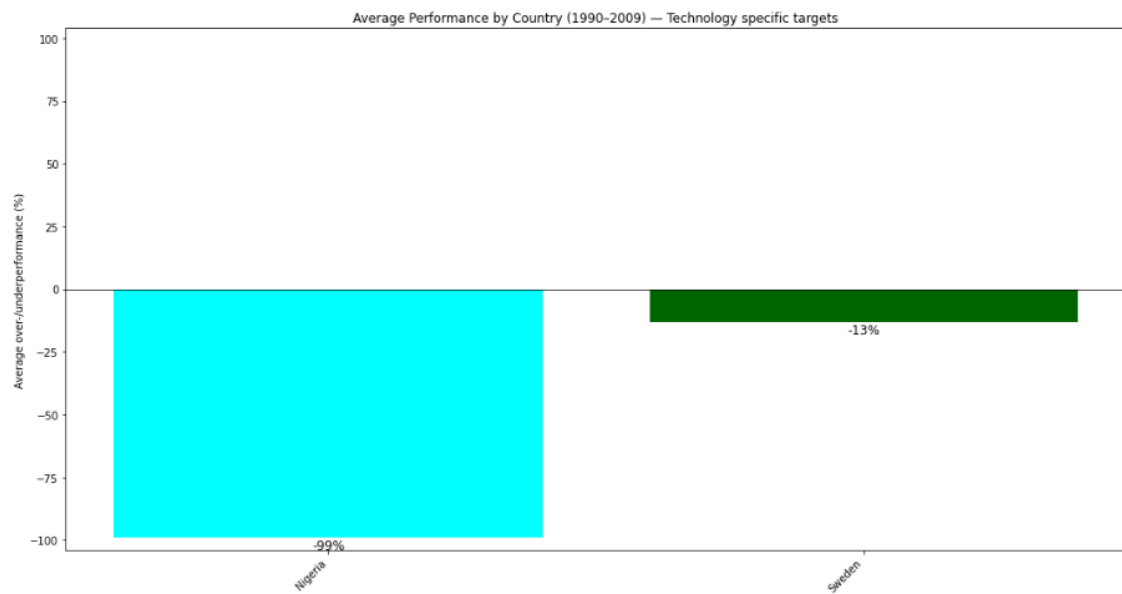


Figure 4.36: Achievement of technology specific targets for the years 1990-2009.

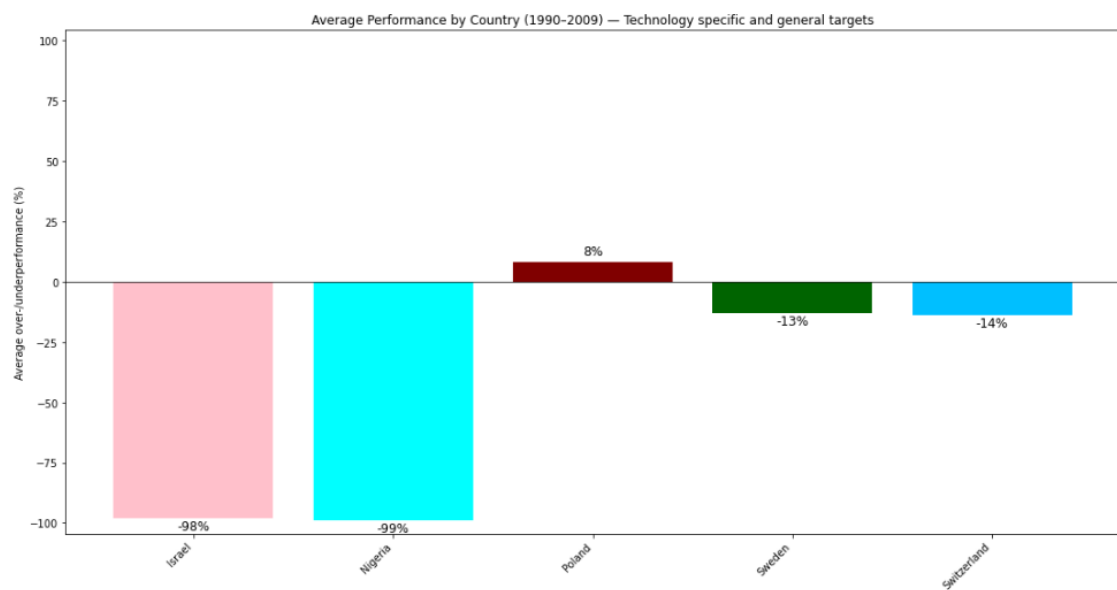


Figure 4.37: Achievement of all targets for the years 1990-2009.

### Performance rate of the targets for 2010 - 2015

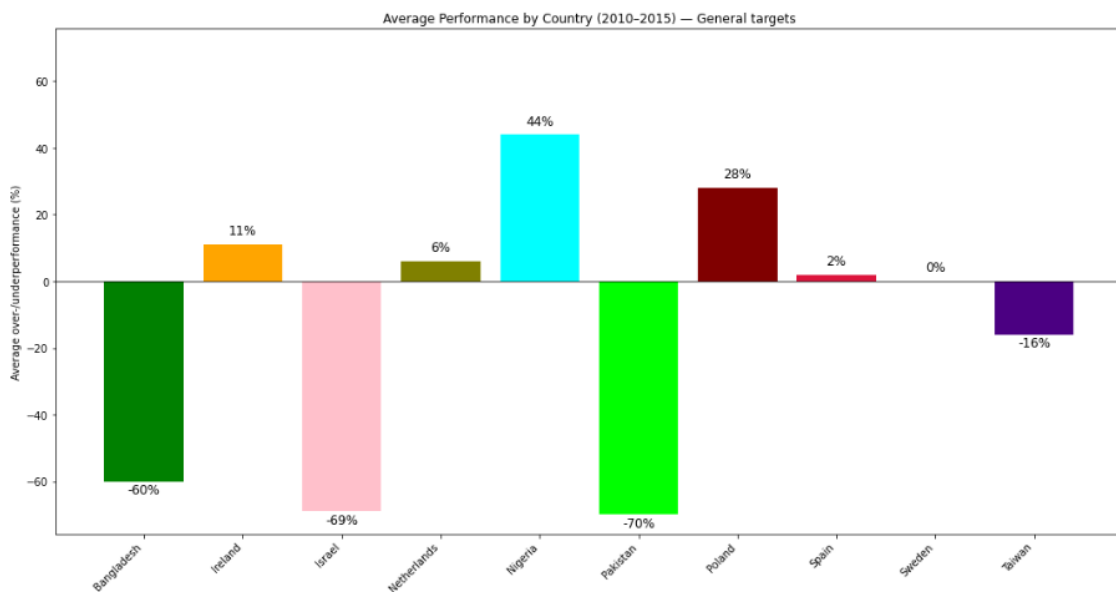


Figure 4.38: Achievement of general targets for the years 2010-2015.

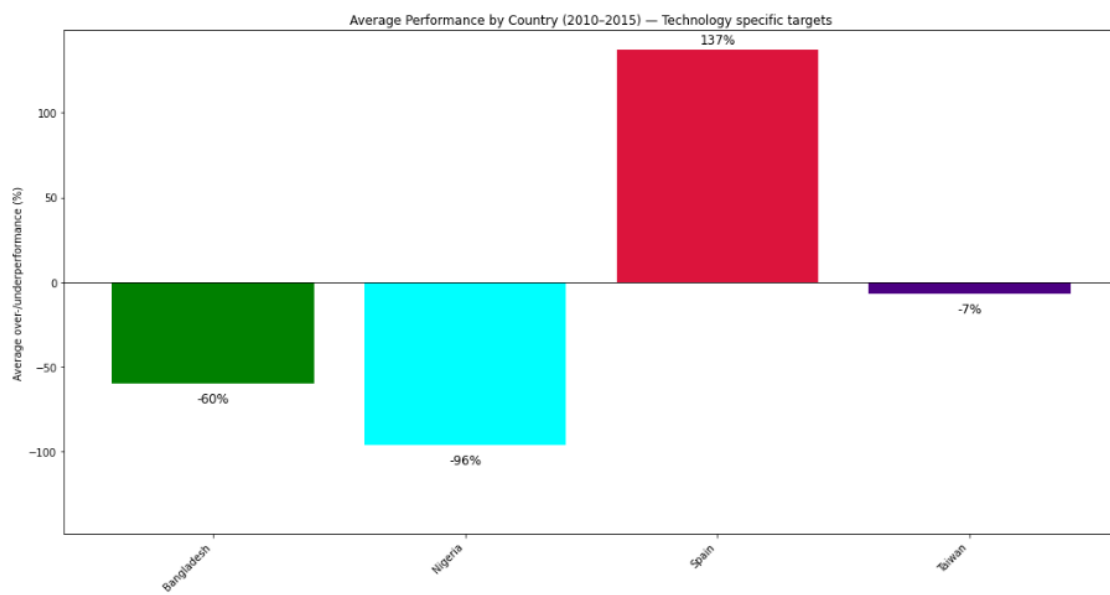
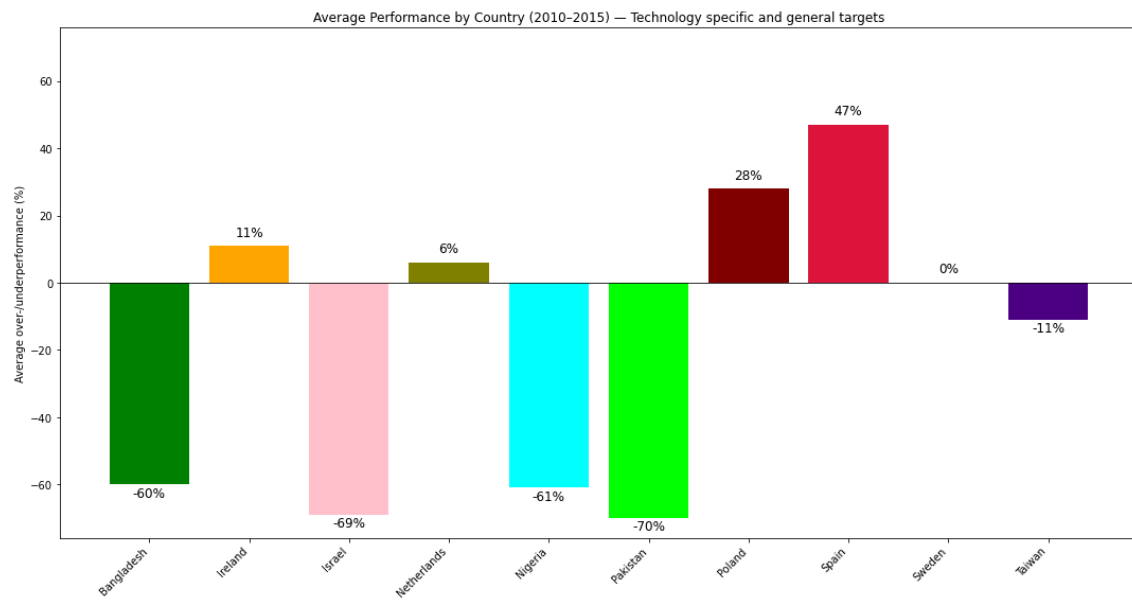


Figure 4.39: Achievement of technology specific targets for the years 2010-2015.



**Figure 4.40:** Achievement of all targets for the years 2010-2015.

## 4. Results

### Performance rate of the targets for 2016 - 2024

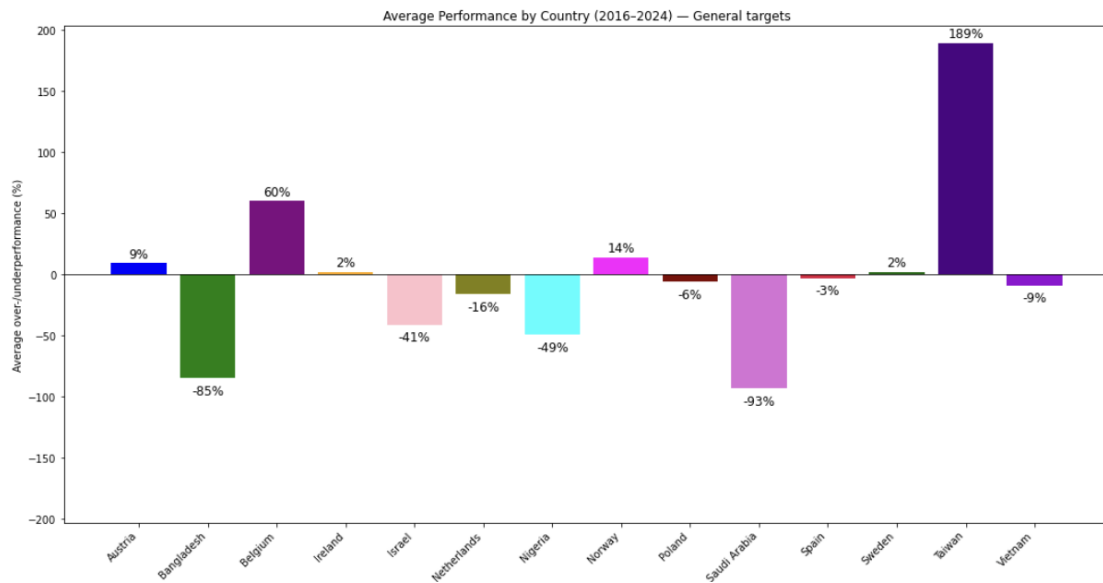


Figure 4.41: Achievement of general targets for the years 2016-2024.

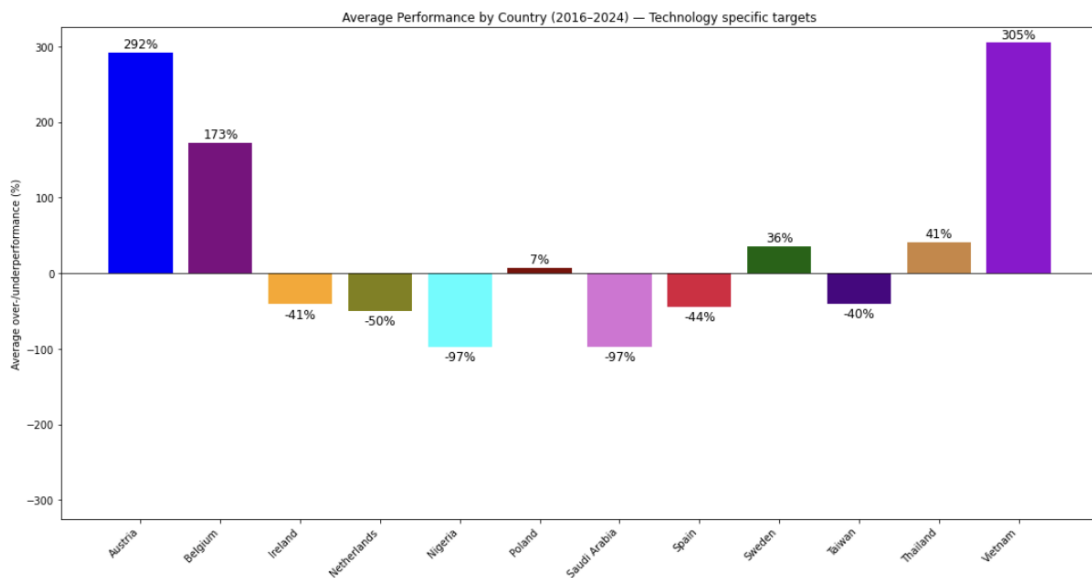
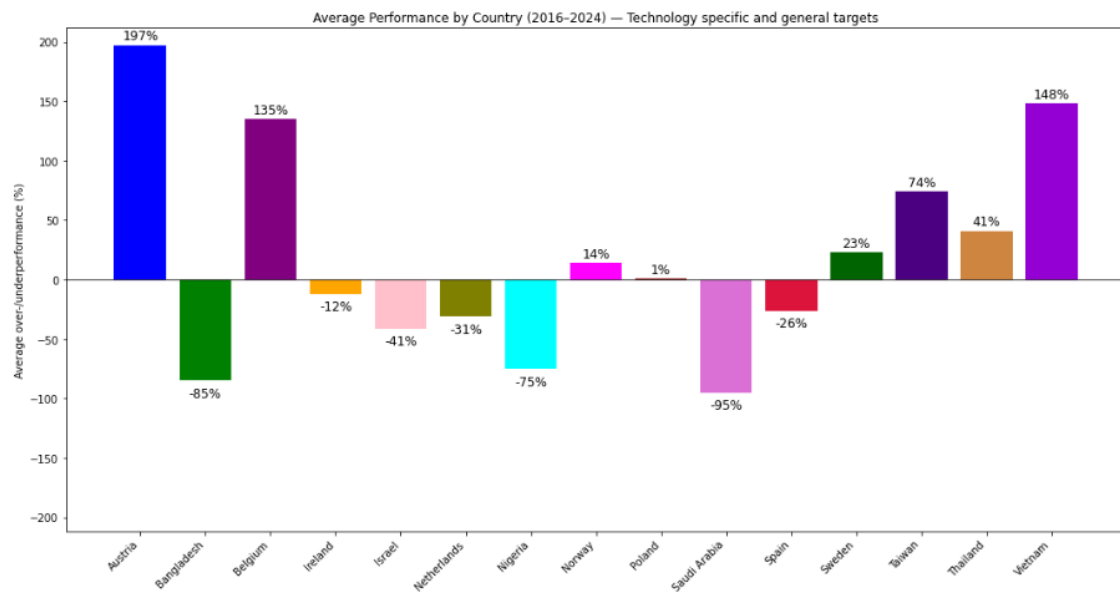


Figure 4.42: Achievement of technology specific targets for the years 2016-2024.



**Figure 4.43:** Achievement of all targets combined for the years 2016-2024.

The visualisations show a clear trend: over time, more countries have established both general and technology specific targets. Before 2010, only five countries had set any targets, but within the next five years, that number had doubled. In the most recent period, only three countries from the study had not set targets, meaning 15 countries are now represented.

In the earliest period, only one country, Poland, reached its target, representing 20% of all countries included at that time. While this was a general target, Poland had not adopted any technology specific targets, and those countries that did were ultimately unsuccessful in achieving them. Most targets in this period were general in nature, with only two countries aiming for technology specific goals.

Between 2010 and 2015, ten countries were represented in the visualisations. Out of these, five countries met all of the targets, corresponding to 50%. All of these were classified as developed countries. Regarding general targets, the same countries met or even overachieved their goals, with Nigeria also joining this category by overachieving its general target while underachieving its technology specific goal. Overall, most rapidly developing countries underachieved in this period, with the notable exception of Taiwan.

During the 2016–2024 period, the trend persisted: a greater number of countries set general targets compared to technology specific ones. Of the 14 countries that set general targets, eight failed to meet them. In contrast, six out of twelve countries succeeded in achieving or overachieving their technology specific targets, corresponding to a 50% success rate. In total, eight out of 15 countries met at least one of their targets during this period. The previously observed distinction between developed and rapidly developing countries becomes less pronounced in this time-frame, with results being more evenly distributed, some countries from both groups either over-

achieving or underachieving in both categories.

To conclude this section, about 50% of the countries met or overachieved set targets. A closer analysis shows that for some countries, the performance improved with each subsequent period. This mostly occurs to countries classified as rapidly developing with the exception of Sweden who did not meet its target between 1990 and 2009, but achieved it during 2010-2015, and exceeded it in the period from 2016-2024. This pattern can also be observed in other countries, such as Israel, where target accuracy improved over time. However, this can differ a lot between the countries and not all of them are following this pattern. Several countries show a decrease in performance over time, many of which are classified as developed, for example Spain and the Netherlands. The different visualisations for technology specific and general targets also show another pattern. While the performance differed between the countries and the time periods, the performance of general targets seems to have been more precise while technology specific targets often were significantly over- or underachieved.

To sum up, this chapter presented relevant background information and the results of each individual country's analysis. Each country's targets and progress was presented through visualisations and tables that illustrate performance rates over time. Finally, comparative visualisations of each country's performance over time and for the difference in targets was shown and analysed.

# 5

## Discussion

This chapter discusses the findings from the results. The chapter begins by summarising and analysing the differences observed and their implications in order to answer the research questions stated below, before moving on to describing the limitations in the results.

- To what extent do ambitious renewable energy targets translate into effective outcomes and how has this developed over time?
- How does the performance differ between technology specific and general targets?
- In what ways, if any, does the setting of a target and the achievement differ between rapidly developing and developed countries?

The discussion begins with answering the first research question, by analysing the performance of the countries' targets and how they have development over time. To further answer the first research question the difference in ambition level and its outcomes is discussed. Then, a discussion on the difference between technology specific and general, RES, targets follows, answering the second research question. Lastly, the final research question is answered by comparing developed and rapidly developing countries and analysing patterns found in the result.

## 5.1 Performance

The results show that between 1990 and 2009, only five countries had established targets. Two of these, Nigeria and Israel, both rapidly developing nations, significantly underachieved their goals. Each of these countries set three or fewer targets. Sweden and Switzerland also underachieved, though to a lesser extent. Poland was the only country to exceed its targets during this period. A key distinction in Poland's approach was its consistent target setting strategy, focusing on a single target type with annual goals, thereby fostering continuous development. In contrast, the other four countries set only isolated, one-off targets during the same period. This suggests that the number of targets, or the continuity in target setting, may positively influence the achievement of goals. Notably, during this time frame, there was no clear difference in outcomes between RES-wide and technology specific targets.

For the time period 2010-2015, ten countries targeted renewable energy. Out of these, five classify as developed and five as rapidly developing. The trend previously described persists; rapidly developing countries tend to underachieve their renewable energy targets, while developed countries generally overachieve. Nonetheless, the degree of underachievement among rapidly developing countries decreased, indicating growth in renewable energy deployment rather than stagnation. Taiwan stands out as a unique case, showing a relatively low level of underachievement. In contrast, overachievement among developed countries is largely due to the early underestimation of solar power potential during the 2010's. During this time period, the countries set approximately the same amount of targets, there is no clear difference or apparent pattern.

In the final time period, 2016-2024, 15 countries are represented. During this period, a notable shift has occurred: the performance gap between rapidly developing and developed countries has become more balanced. For most developed countries represented in both time periods, the performance is lower in 2016 to 2024 than in 2010 to 2015. For many rapidly developing countries, the development is the opposite. The Paris Agreement, which entered into force in 2016, likely played a significant role in shaping the target setting strategies of the studied countries. The results specifically indicate that rapidly developing countries are making progress. This shift over time may be attributed to the introduction of the Paris Agreement, which redefined the concept of accountability in climate policy. Under the Agreement, countries are made accountable for setting, monitoring, and reporting on their own targets and strategies. Previously, more of this responsibility was held by external regulators. With this shift, countries may have adopted new approaches to their energy transitions, contributing to the observed changes in performance during this period. However, this is a hypotheses and the reasons could be attributed to other factors.

Future targets can be partly analysed with help of the extrapolated data. It seems as if many countries which have already begun their expansion of certain types of renewable energy continue on a trajectory leading to target achievement. It is noted

that the majority however need to accelerate their expansion and transition in order to meet future targets. Countries who have expanded less or even not at all, are not following that trend. Those countries may need to make radical changes and create a more exponential increase of their numbers in order to meet their targets. Nigeria and Saudi Arabia have set targets, however their actual data remains at a very low level, and therefore they are part of the countries needing radical changes in order to change their current trajectory and achieve their targets. This also applies to offshore wind targets in many countries. With some exceptions, several countries have set relatively ambitious offshore wind goals, despite currently having very low or even no installed capacity. Solar targetting in Norway follows the same pattern, making it an outlier in that category. The Philippines only have targets for the future which excludes them from country comparison. Their overall projections seem to follow a sustained growth but with mixed results for their performance.

Sweden stands out among EU countries for its continued increase in target achievement across the assessed time period, an exception to the general trend observed among developed countries. This may be partly explained by Sweden's early progress in renewable energy deployment. The country has exceeded both national and EU-mandated renewable energy targets well ahead of schedule. As a result of this overachievement, Sweden has enjoyed greater flexibility in recent years and has faced less pressure to adopt new or more ambitious national targets. In fact, in contrast to most other countries, Sweden has made few significant updates to its renewable energy goals, with the notable exception of revising the 100 percent renewable installed capacity goal for 2040.

## 5.2 Level of ambition

The results of this report indicate several potential outcomes of setting ambitious targets. In some cases, targets appear bold on paper but do not translate into real progress. Nigeria and Saudi Arabia exemplify this pattern: despite setting targets that could be perceived as ambitious, their actual renewable energy deployment remained consistently low, resulting in significant underachievement. This suggests that ambitious targets alone do not necessarily drive faster transitions or enhance the progress of a country's energy transition.

Another possible outcome of ambitious target setting is partial progress, where targets are not fully met but notable advancements are made. This can manifest in several ways. For example, the Netherlands follows a trajectory where the pace of progress would have allowed them to meet their target if the transition had started earlier. As a result, they do meet their targets, but only a few years later than planned. Another example of this is Pakistan's RES targets for installed capacity. In this case, a less ambitious target was initially set for a year that was relatively close to the time of target setting, but little progress followed. Shortly afterward, however, a more ambitious target was introduced for a later year, and this coincided with a noticeable increase in actual data. Although the progress occurred too late to meet the initial target, the rate of development improved, and the trajectory began

to align with the new target. These examples suggest that more ambitious targets can still play an important role in driving progress, even if they are not achieved within the original time frame. This is also an example of a possible limitation discussed in a section below where the performance calculation does not catch such target achievement that happens "too late".

Furthermore, another outcome exists where ambitious target setting may cause target achievement within the targeted time frame. One example of this is Vietnam's electricity generation targets. The visualisation in the result section show how Vietnam sets what might be considered as ambitious targets in comparison to the historical levels and then starts to follow the trajectories, leading them toward achieving the targets. This example suggests that setting ambitious targets leads to successful target achievement, but it is difficult to say that it is the ambitious target itself that causes a faster transition or if it would take place without the ambitious target as well.

Gencer and van Ackere argued that short term targets within one year, or long term targets without intermediate targets would result in better accuracy than a singular target within five years (Gencer & van Ackere, 2021). This can be compared to Taiwan's results where targets were set with a very small time-frame and it appears that the country reached most of the targets. This implies that Gencer and van Ackere's argument is supported in this situation. However, the writers also stated that it is more cost efficient with a target within five years and this method of developing renewable energy technologies might not be suitable for all countries due to differences in their economic situation and available resources.

Several countries target less ambitious targets for solar power. However, it is clear that these targets did not significantly influence actual development, as they were largely overachieved. Targets tend to play a smaller role when a technology, such as solar power, becomes economically viable and widely available. Once solar power became competitive in the market, it seems as if its growth was driven more by market forces and technological improvements than by political targets.

Beyond measurable performance, the ambition level of targets may also influence public perception and political discourse. Overambitious or consistently unmet targets can lead to dissatisfaction, causing the public to lose faith in climate policy and in governmental institutions in general. This dynamic may be politically exploited by actors seeking to delay or undermine the energy transition. In contrast, targets that are perceived as both challenging and achievable may reinforce public support and build legitimacy around renewable energy policies. Thus, the societal and political impact of target setting deserves closer attention.

Drawing a conclusion on how the ambition level of targets affects performance is challenging. It raises the question of how an ambitious target should be defined. Should it mainly be based on historical levels, the pace of progress, or the direction of development? Furthermore, should a country's individual circumstances and pre-

conditions be taken into account, making the comparisons more complex but also more representative and reliable?

### 5.3 General and technology specific targets

A general pattern observed across many countries is that RES targets tend to be more precise, as they show relatively lower levels of both underachievement and overachievement compared to technology specific targets. For technology specific targets, many countries seem to under- or overestimate their usage more often. This pattern might appear because technology specific targets only depend on one technology and therefore are more sensitive to under- or overestimations. For general targets, one could argue that the different technologies can compensate for deficits within each other and in that way, to some extent, offset the most severe under- or overachievements.

A general target leaves more room for technical and economic development, whereas a technology specific target attempts to predict conditions several years in advance. For example, several earlier targets for solar power severely underestimated the potential growth of the technology. In contrast, during the research for this project, targets for biomass were studied and found to have been overestimated in the 2010s. The research showed that biomass was not an optimal technology and came with consequences that were previously unknown. As a result, several countries did not achieve their biomass targets or revised them downward. This supports the argument for general targets that offer greater flexibility. This seems to coincide with Breetz's findings on how more flexible incentive structure may lead to more innovation (Breetz, 2020). The target may not be achieved the way the policymakers envisioned it but a more general approach seems to have a greater probability to achieve set targets. A counterpoint to this is that technology specific targets could also lead to greater ability to act due to a clearer direction. This is supported by Sewerin (Sewerin et al., 2023), who argues that a specific policy can accelerate the transition, while a broad policy may either not be implemented or simply maintain the status quo. Overall, the literature seems to mostly support the observed pattern of variations in precision between general and technology specific targets.

### 5.4 Developed and rapidly developing countries

The results indicate a pattern where the developed countries have a higher accuracy and performance compared to the rapidly developing countries. However, the performance varies considerably between rapidly developing countries. The comparison is complex, and therefore hard to assess and generalise, due to reasons more thoroughly described in the limitations section below.

All the developed countries in this study are European, and almost all are either members of or cooperate with the EU. They therefore have both obligations and support that non-EU countries do not have. This most likely has had an effect on

how these countries act and on the results in this thesis. However, three rapidly developing countries; Thailand, Vietnam and the Philippines are also members of a cooperative community, ASEAN, which provides similar opportunities to its member states. This could explain why those rapidly developing countries seem to be transitioning in a slightly more effective manner with higher achievement than those that are not part of such a community.

## 5.5 Limitations and reliability

There are several aspects that limit the ability to draw a conclusion and that affect the conclusions' reliability in this project. In this section, these aspects are described and discussed.

Due to the narrow selection of 18 countries, the whole world is not covered. As a result a limitation of the study is that some parts of the world will be underrepresented. For example, all developed countries in this study are in Europe, Africa is underrepresented and neither North- or South America is represented in this report. As a result, this study cannot fully represent all countries' ability to successfully meet their renewable energy targets. In the same vein, the analysis does not take the respective countries' specific circumstances into account when comparing their success in reaching their goals.

One main concern about the results and discussion is that there is no way to know what actually causes the achievements. While it may seem like ambitious target setting is the cause of change, this may not be the case. There are many factors and external effects that affect a country's renewable energy policy and what happens to its energy mix. Connected to this concern is that this project does not make any comparisons to countries or cases that do not use targets for renewable energy transitions. Due to this, it may be difficult to understand the impact of target setting. This also makes it harder to confirm that the outcomes observed are actually connected to the target setting itself and not something else.

Another limitation that should be taken into account is that the result presented in this report does not take into account if a target is met at a later date than expected. A country that achieves the target a few years later and a country which never reaches the target could have the same outcome in our result. This would impact the conclusion of this study since the target most likely still had an impact on the country's development. Related to this is that some countries, for example Nigeria and Saudi Arabia set quite ambitious targets, but then no progress at all was made. In this project there is a lack of knowledge regarding why this happens, which makes it difficult to analyse the results from these countries.

A major factor also causing uncertainty is the underestimation of certain technologies when targets are set. This became especially clear in the case of solar power where many countries did not expect solar power to play as big of a role as it later did, which led to many targets being severely overachieved. This may not only have affected the evaluation of how well solar targets perform, but also the overall performance scores for the countries. This is especially noticeable in the case with the Netherlands and Poland where two targets had to be removed due to them exceeding a 1000% performance rate.

Yet another point requiring reflection is that the term "rapidly developing" can be problematic in this project. It often reflects a western perspective on growth

and modernisation and implies a desired and linear path toward a model shaped by industrialised countries, overlooking alternative development trajectories, local contexts, and different societal priorities. It risks portraying countries as "lagging behind" rather than recognising diverse forms of progress on national terms and conditions.

Furthermore, even after this categorisation of developed and rapidly developing countries, there are quite big differences between the countries within the categories, for example, Nigeria and Taiwan are very different from each other, but they are still in the same category.

In addition, it may be unfair to compare developed countries with rapidly developing countries, as the latter may be expanding their electricity grids under different circumstances. Rapidly developing countries often experience significant population growth and varying levels of electricity access, which influences how their grids are built and expanded. This can affect the outcomes for indicators based on "share" metrics. For example, if a country is simultaneously expanding its electricity grid and increasing its renewable energy capacity, the overall share of renewables may decrease even though the absolute amount of renewable energy is growing. As a result, rapidly developing countries may appear to underachieve their share based targets more often, even while making substantial progress in absolute terms.

Another factor that can make the comparison seem unfair is the fact that the pre-conditions may be very different. Rapidly developing countries tend to be over-represented when it comes to vulnerability to climate change and extreme weather because of geographical differences as well as infrastructure, economy and other social factors. This may cause significant consequences on the ability to transition and is not accounted for in this report or this way of comparing countries.

Finally, another limitation in this report is that the motivations behind target setting may differ substantially between countries. There is little information about what motivates a country to set targets. In this project this becomes a knowledge gap. Why do some countries set multiple and ambitious targets with seemingly no efforts to achieve them? The motives may differ depending on what obligations a country has. A developed country that is a member of the EU may set targets because it is obligated to do so, because it actually believes the transition is necessary for the country's benefit, or perhaps because it wants to attract investors or financing from climate funds by sending a signal that transition is taking place, or is about to do so. This may also be applied to rapidly developing countries wanting to signal an aspiration for further industrialisation and growth to the international community. The question also arises if some countries may want to set many ambitious targets in order to, for example, keep their industries competitive in the global market or strengthen political leverage both nationally and internationally. As both Haarstad and Breetz mention in their respective papers the ambitiousness of a policy is closely tied to politics, supporting these alternative reasons behind targeting (Breetz, 2020; Haarstad, 2020).

## 5.6 Further research

While this project to some extent begins to explore the importance of target setting for energy transitions, there are many facets of this topic that still remain unanswered. This report scratches the surface of the topic and highlights the need for further research as many questions arise from the discussions.

Some areas that seem relevant to further investigate in order to develop this research topic are:

- How will the patterns observed in this thesis develop over time? Most countries have an increasing number of targets in the future. By repeating a similar study at a later date when the deadlines for more countries' targets have passed, the research questions could be answered to a greater extent.
- How general and technology specific targets differ when it comes to target achievement, and what causes that difference.
- How countries' individual preconditions may affect their target setting, and how those preconditions can be taken into account when evaluating the performance of countries' target setting.
- How a comparison with instances where targets are not set may be able to deepen the understanding of how, and if, the acceleration of transitions is connected to target setting.
- Societal and political impact on performance. How the general public and opinion affect the countries' target setting and actual achievement?

## 5.7 Summary

In the discussion chapter, the results previously presented were reviewed and evaluated in order to address the research questions. The discussion began by analysing the performance in meeting national targets and the ambition level in setting them. This was followed by a comparison between technology specific and general targets, and finally, a comparison of performance between developed countries and rapidly developing ones. After this discussion and the attempt to answer the research questions, the limitations of the analysis were outlined. The chapter was concluded with a description of potential areas for future research that could provide deeper insights into the topic.



# 6

## Conclusion

In light of the ongoing climate change and the associated energy transitions aimed at mitigating it, this study examined the effectiveness and usefulness of target setting as a tool in national energy transitions. The analysis focused on the progress of 18 countries in achieving their national renewable energy targets.

To gain a deeper understanding, the project reviewed relevant literature and explored different scholarly opinions on targets as an effective tool for energy transitions. Main takeaways included a disagreement about what impact broad and specific policy have on actual developments and transitions, where some scholars suggest that broad policy enables more innovation while others state that specific policy promote development. The analysis also highlighted an existing gap in knowledge regarding the actual outcome of renewable energy targets in countries with different preconditions, since previous studies mainly focused on economically developed countries.

In addition to conducting an overall analysis of the role targets play in national energy transitions, this thesis aimed to contribute to filling previously mentioned knowledge gaps. In order to accomplish this, the project collected set targets from the chosen countries and compared them to the actual development of targeted technology, both by visualising this individually and comparing the countries performance rates over different time periods.

Firstly, a main finding of the study was the differences in achievement over time between developed and rapidly developing countries. The results showed how developed countries had a higher performance historically, but during recent years that has changed. The developed countries' performance stagnated and began decreasing during the later time periods. This is the case for the Netherlands, which overachieved their targets for 2010-2015 and underachieved for 2016-2024. At the same time, rapidly developing countries instead increased their performance. This increase varies, for most rapidly developing countries it means that there is less underachievement, as in the case of Israel, but for a few, such as Taiwan, it also represents a shift towards overachievement.

Secondly, the project found differences when exploring the performance rates over different time periods. More targets were set in the later time periods and far more countries are represented. A shift in target setting was observed after the Paris Agreement in 2015, as more countries adopted targets and performance became

more evenly distributed across nations. Achievement has also become more precise, with less extreme instances of under- or overachievement. This suggests that targets have become more deliberate and realistic, and/or that such international policy frameworks encourage target adoption and strengthen the incentives to meet them.

Lastly, the discussion found a difference in performance between general and technically specific targets. It appears as if general targets had a more exact performance during the studied time period, while the technically specific targets seemed to present more varying results. The reasoning behind this was that general targets can be more flexible when it comes to unexpected changes in external factors, such as market fluctuations and technical developments. Technically specific targets cannot be adapted to similar situations to the same extent. An example of extreme over- and underestimations is shown in the visualisations of the Netherlands and Ireland. The Netherlands severely underestimated the future implementation of solar power, while Ireland overestimated the implementation of offshore wind. The more precise nature of the general targets can be observed in Sweden and Spain, almost precisely aligning the actual development with the targets in the two latest time periods.

Additionally, the discussion and limitations found that the results show a range of outcomes in relation to the targets. In some cases, it is clear that the target has influenced actual development, with the goal either being met or nearly achieved. This becomes particularly obvious in the case of Thailand, where increase in implementation starts right after targets are set. In others, the targets are found to be unrealistic and are subsequently revised, as seen in for example Taiwan. There are also cases where the targets appear to have little or no impact on initiating a transition or accelerating progress, with actual development continuing along business-as-usual trajectories. This can be observed in the case of both Nigeria and Saudi Arabia. For many countries, it is difficult to determine the outcome of the target itself, as well as the underlying motivations for setting the target and the true drivers behind observed developments. Comparing the selected countries using the same measures is challenging due to significant differences in their initial conditions. Moreover, given that the study is limited to 18 countries, drawing broad generalisations is not feasible.

Finally, further research is needed to fully understand the subject and to draw specific conclusions on the effectiveness of targets. For a more balanced analysis, future studies should take into account countries' preconditions and analyse what impact societal and political factors have on target performance. Additionally, as more target deadlines pass, further research would be valuable for drawing deeper and more robust conclusions. Continued research in this area is highly relevant for future development within national and global transitions toward sustainability.

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A

Appendix I

# APPENDIX I - Target collection

This appendix outlines the collection and documentation of renewable energy targets relevant to the project. It includes all targets used in the analysis, as well as additional targets that were excluded from the scope—for instance, those relating to hydropower or biomass. The scope of the project was narrowed to focus specifically on wind and solar power as technology-specific targets. Consequently, while some sources may contain broader renewable energy targets, only those relevant to the project's focus are presented here.

For targets covering all renewable energy sources, the abbreviation *RES* is used, with specifications where applicable (e.g., *RES incl.hydro* or *RES excl.hydro*). This includes both energy and electricity targets. However, it is important to note that *RES-E* is the correct term when referring specifically to electricity targets (e.g., gross final electricity consumption). For readability and relevance, this distinction may not always be consistently applied in this appendix, as the primary focus is to identify which energy sources are being targeted.

The appendix is organized by country in alphabetical order. Within each country section, the relevant sources (primarily policies or governmental documents, and occasionally scientific articles) are listed in chronological order. Under each source, the targets extracted have been stated as interpreted for the purpose of the project. This includes both explicit statements and inferred targets, supported by any assumptions made, quoted excerpts, data tables, and calculations. Where a single source includes multiple types of targets (e.g., installed capacity, electricity generation), these have been categorized accordingly for clarity.

A complete reference list is provided at the end of the appendix, covering all cited sources as well as additional materials used for target interpretation or conversion.

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## 1 Austria

### 1.1 National Renewable Energy Action Plan 2010 for Austria (NREAP-AT) under Directive 2009/28/EC of the European Parliament and of the Council.

*Note: Although this report was published in 2010, for the purposes of this project, all targets from the NREAP reports are assumed to be set from 2011. This simplification is due to several countries updating their reports and not implementing them until 2011.*

This source is the 2010 National Renewable Energy Action Plan of Austria (NREAP-AT). The plan was created in accordance with Directive 2009/28/EC of the European Parliament and of the Council. The document sets out Austria's national strategy and targets for renewable energy to be achieved by 2020.

In the NREAP report from 2010 Austria targeted the following for renewable electricity generation in 2020:

- 42 112 GWh hydropower without pumping.
- 44 844 GWh hydropower with pumping.
- 2 GWh geothermal electricity.
- 306 GWh solar power.
- 4 811 GWh onshore wind power.
- 5 147 GWh biomass electricity.

**Exact mention:** *“Estimation of total contribution (installed capacity, gross electricity generation) expected from each renewable energy technology in Austria to meet the binding 2020 targets and the indicative interim trajectory for the shares of energy from renewable resources in electricity 2010-2014.”*

**Table 10 Estimation of total contribution (installed capacity, gross electricity generation) expected from each renewable energy technology in Austria to meet the binding 2020 targets and the indicative interim trajectory for the shares of energy from renewable resources in electricity 2010-2014**

Electricity (GWh)	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Hydro (without pumping) (MW) (GWh)	7 907 37 125	8 235 38 542	8 257 38 649	8 286 38 783	8 322 38 951	8 367 39 161	8 423 39 423	8 493 39 750	8 580 40 160	8 690 40 672	8 826 41 312	8 997 42 112
<1 (MW) (GWh)	308 1 448	455 2 129	456 2 135	458 2 142	460 2 152	462 2 163	465 2 178	469 2 196	474 2 218	480 2 247	488 2 282	497 2 326
1 MW - 10 MW (MW) (GWh)	692 3 247	726 3 400	728 3 409	731 3 421	734 3 436	738 3 454	743 3 477	749 3 506	757 3 543	767 3 588	779 3 644	794 3 715
> 10 MW (MW) (GWh)	6 907 32 430	7 053 33 013	7 073 33 105	7 098 33 220	7 128 33 364	7 167 33 543	7 215 33 768	7 275 34 048	7 349 34 399	7 443 34 838	7 560 35 386	7 707 36 071
Plus pumping (MW) (GWh)	3 929 2 738	4 285 2 732	4 285 2 732	4 285 2 732	4 285 2 732	4 285 2 732	4 285 2 732	4 285 2 732	4 285 2 732	4 285 2 732	4 285 2 732	4 285 2 732
Geothermal (MW) (GWh)	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2
Solar (MW) (GWh)	22 21	90 85	104 99	120 114	138 131	157 149	179 170	202 192	228 217	256 243	288 273	322 306
Photovoltaic (MW) (GWh)	22 21	90 85	104 99	120 114	138 131	157 149	179 170	202 192	228 217	256 243	288 273	322 306
Concentrated solar power (MW) (GWh)	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
Wind (MW) (GWh)	694 1 343	1 011 2 034	1 232 2 460	1 435 2 844	1 621 3 189	1 793 3 500	1 951 3 780	2 096 4 032	2 231 4 258	2 355 4 462	2 471 4 646	2 578 4 811
Onshore (MW) (GWh)	694 1 343	1 011 2 034	1 232 2 460	1 435 2 844	1 621 3 189	1 793 3 500	1 951 3 780	2 096 4 032	2 231 4 258	2 355 4 462	2 471 4 646	2 578 4 811
Offshore (MW) (GWh)	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0

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**Table 10 Estimation of total contribution (installed capacity, gross electricity generation) expected from each renewable energy technology in Austria to meet the binding 2020 targets and the indicative interim trajectory for the shares of energy from renewable resources in electricity 2010-2014 (continued)**

Electricity (GWh)	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Biomass (MW) (GWh)	976 2 823	1 211 4 720	1 213 4 733	1 215 4 749	1 219 4 769	1 223 4 794	1 228 4 826	1 235 4 865	1 243 4 914	1 253 4 975	1 265 5 051	1 281 5 147
Solid (MW) (GWh)	892 2 507	1 099 4 131	1 100 4 142	1 103 4 155	1 105 4 172	1 109 4 194	1 114 4 223	1 120 4 259	1 127 4 305	1 137 4 364	1 149 4 437	1 164 4 530
Biogas (MW) (GWh)	72 283	97 553	98 556	98 559	99 561	99 564	100 567	100 570	101 573	101 576	102 578	102 581
Bioliqids (MW) (GWh)	12 33	15 36	15 36	15 36	15 36	15 36	15 36	15 36	15 36	15 36	15 36	15 36
Renewables in electricity (MW) (GWh)	9 600 41 314	10 547 45 383	10 808 45 944	11 058 46 493	11 301 47 043	11 541 47 607	11 781 48 200	12 027 48 841	12 283 49 550	12 555 50 354	12 851 51 284	13 179 52 377
Of which in CHP (MW) (GWh)	594 1 718	829 3 229	831 3 241	833 3 255	837 3 273	841 3 295	846 3 323	852 3 358	860 3 402	871 3 456	883 3 525	899 3 610

Table from page 86

Bittermann, W., Karner, A., Kettner, C., Kletzan-Slamanig, D., Koller, S. C., Köppl, A., ... Steininger, K. (2010). *National Renewable Energy Action Plan 2010 for Austria (NREAP-AT) under Directive 2009/28/EC*.

[https://build-up.ec.europa.eu/sites/default/files/content/national\\_renewable\\_energy\\_action\\_plan\\_austria\\_en.pdf](https://build-up.ec.europa.eu/sites/default/files/content/national_renewable_energy_action_plan_austria_en.pdf)

Accessed 2025-02-16

## **1.2 NREAP - Renewable Energy Projections as Published in the National Renewable Energy Action Plans of the European Member States**

*Note: In this source, every country's NREAP report is compiled and published by the European Union. The majority of the targets mentioned in this source were collected from the previous document, with the exception of the target for gross final energy/electricity consumption as well as installed capacity.*

The Renewable Energy Directive (2009/28/EC)<sup>1</sup> addresses various subjects related to the development of renewable energies in the European Member States, among others the legally binding share of renewable energy in gross final energy consumption. In Article 4 of the Directive each Member State is requested to provide a National Renewable Energy Action Plan (NREAP) by 30 June 2010. Several countries updated their plans in 2011.

### 1.2.1 Gross final energy consumption

In this NREAP report published in 2011, Austria targeted 34% renewable gross final energy consumption for 2020.

### 1.2.2 Gross final electricity consumption

In this NREAP report published in 2011, Austria targeted 70,6% renewable gross final electricity consumption for 2020 (RES-E).

The total target in gross final electricity consumption (RES-E, assumption including hydro) consumption is also mentioned as 4504 ktoe. This was converted to 52.38152 TWh (Unit Juggler, n.d.).

**Exact mention:**



Table from page 221

### 1.2.2 Installed capacity

In this NREAP report published in 2011, Austria targeted the following for renewable installed capacity by 2020.

- 8 997 MW Hydropower
- 1 MW geothermal electricity
- 322 MW Solar
- 2578 MW Wind
- 1281 MW Biomass

### Exact mention:

Table 75: *Projected total solar electric capacity [MW] for the period 2005 - 2020, including photovoltaic (PV) and concentrated solar power (CSP)*

	2005 [MW]	2010 [MW]	2015 [MW]	2020 [MW]	2020 [%]
Belgium	2	350	713	1340	1
Bulgaria	0	9	220	303	0
Czech Republic	1	1650	1680	1695	2
Denmark	3	3	4	6	0
Germany	1980	15784	34279	51753	57
Estonia	n.a.	n.a.	n.a.	n.a.	n.a.
Ireland	0	0	0	0	0
Greece	1	184	1300	2450	3
Spain	60	4653	8966	13445	15
France	25	504	2353	5400	6
Italy	34	2505	5562	8600	9
Cyprus	0	6	87	267	0
Latvia	0	0	1	2	0
Lithuania	0	1	10	10	0
Luxembourg	24	27	88	113	0
Hungary	n.a.	0	19	63	0
Malta	0	4	27	28	0
Netherlands	51	92	317	722	1
Austria	22	90	179	322	0
Poland	0	1	2	3	0
Portugal	3	156	720	1500	2
Romania	0	0	148	260	0
Slovenia	0	12	37	139	0
Slovakia	0	60	160	300	0
Finland	0	0	0	10	0
Sweden	4	5	7	8	0
United Kingdom	11	50	1070	2680	3
All Member States (total)	2221	26146	57949	91419	<b>100</b>

More information on subcategories for solar electricity capacity is presented in Table 77 on page 90.  
See Table 78 on page 91 for corresponding solar electricity production data.

Table from 88

Table 91: *Projected total wind power electric capacity [MW] for the period 2005 - 2020, including both onshore and offshore wind power*

	2005 [MW]	2010 [MW]	2015 [MW]	2020 [MW]	2020 [%]
Belgium	190	733	2049	4320	2
Bulgaria	8	336	984	1256	1
Czech Republic	22	243	493	743	0
Denmark	3129	3584	4180	3960	2
Germany	18415	27676	36647	45750	21
Estonia	31	147	400	650	0
Ireland	494	2088	3151	4649	2
Greece	491	1327	4303	7500	4
Spain	9918	20155	27997	38000	18
France	752	5542	13445	25000	12
Italy	1639	5800	9068	12680	6
Cyprus	0	82	180	300	0
Latvia	26	28	104	416	0
Lithuania	1	179	389	500	0
Luxembourg	35	35	105	131	0
Hungary	n.a.	330	577	750	0
Malta	0	0	7	110	0
Netherlands	1224	2221	5578	11178	5
Austria	694	1011	1951	2578	1
Poland	121	1100	3540	6650	3
Portugal	1063	4256	6125	6875	3
Romania	1	560	3200	4000	2
Slovenia	0	2	60	106	0
Slovakia	5	5	300	350	0
Finland	80	170	670	2500	1
Sweden	536	1873	3210	4547	2
United Kingdom	1565	5430	14210	27880	13
All Member States (total)	40440	84913	142922	213379	100

See Table 94 on page 109 for corresponding wind power electricity production data.

Table from page 106

**Source:** European Environment Agency. (2011). *Renewable Energy Projections as Published in the National Renewable Energy Action Plans of the European Member States.*

[https://www.eea.europa.eu/en/analysis/maps-and-charts/national-renewable-energy-action-plan/nreap\\_draft\\_report\\_eea-ecm\\_20100830.pdf/@@download/file](https://www.eea.europa.eu/en/analysis/maps-and-charts/national-renewable-energy-action-plan/nreap_draft_report_eea-ecm_20100830.pdf/@@download/file)

Accessed 2025-02-17

### 1.3 Federal law consolidated: Complete legal provisions for the Renewable Energy Expansion Act, version of 20 March 2025.

*Note: Translated from german to english through Google Translate.*

In 2021 Austria targeted to have 100% renewable gross final electricity consumption for the year 2030.

**Exact mention:** “*The construction, expansion and revitalisation of plants for the generation of electricity from renewable sources must be supported to such an extent that, from 2030 onwards, total electricity consumption is covered 100% nationally from renewable energy sources.*”

**Source:**

Federal Chancellery of the Republic of Austria.(2021) *.Federal law consolidated: Complete legal provisions for the Renewable Energy Expansion Act, version of 20 March 2025.*

<https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20011619#header> p. 6

Accessed 2025-02-20

## 1.4 Integrated National Energy and Climate Plan for Austria

*Note: Wind power was assumed to only regard Onshore wind power since Austria does not border any sea.*

In 2021 Austria targeted renewable electricity generation for 2030, 2040 and 2050 according to the WEM-scenario (with existing measures) which is a policy scenario that projects future renewable sources with already existing measures. The targets were the following:

- 47 TWh hydropower for 2030.
- 13 TWh solar power for 2030.
- 17 TWh onshore wind power for 2030.
- 6 TWh biomass electricity for 2030.
- 48 TWh hydropower for 2040.
- 15 TWh solar power for 2040.
- 19 TWh onshore wind power for 2040.
- 6 TWh biomass electricity for 2040.
- 48 TWh hydropower for 2050.
- 17 TWh solar power for 2050.
- 22 TWh onshore wind power for 2050.
- 6 TWh biomass electricity for 2050.

**Exact mention:** “Current share of renewable energy in gross final energy consumption and in different sectors (heating and cooling, electricity and transport) and per technology in these sectors” (page 215)

Table 21: Renewable and fossil power generation (WEM scenario)

Application (TWh)	2020	2030	2040	2050
fossil	14	8	8	8
Hydropower	42	47	48	48
Biomass	5	6	6	6
Ambient heat, etc.	0	0	0	0
Photovoltaics	2	13	15	17
Wind	7	17	19	22
<b>Total</b>	<b>69</b>	<b>92</b>	<b>96</b>	<b>101</b>
Application (TWh)	2020	2030	2040	2050
Imports	2	−4	6	11
<b>Boarding</b>	<b>71</b>	<b>87</b>	<b>102</b>	<b>112</b>

Table from page 216

**Source:** Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and technology. (2024). *Integrated National Energy and Climate Plan for Austria*.

[https://commission.europa.eu/document/download/7702dbb6-8677-42ad-8578-56aa5dcde90\\_en?filename=NEKP\\_Aktualisierung\\_2023\\_2024\\_final\\_EN.pdf](https://commission.europa.eu/document/download/7702dbb6-8677-42ad-8578-56aa5dcde90_en?filename=NEKP_Aktualisierung_2023_2024_final_EN.pdf)

Accessed 2025-02-24

## 2 Bangladesh

*Note: Government documents and official publications of Bangladesh were very limited, targets were often discussed but no figures were mentioned. It is clear that former publications have been deleted. The country has become more authoritarian and less open in recent years.*

### 2.1 RENEWABLE ENERGY POLICY OF BANGLADESH

POWER DIVISION MINISTRY OF POWER, ENERGY AND MINERAL RESOURCES  
GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

In 2008 Bangladesh targeted 5% renewable electricity supply (RES including hydro) for 2015. In the same policy, Bangladesh also targeted 10% renewable electricity supply for 2020. (Assumption: RES including hydro)

**Exact mention:** *“Achieve the targets for developing renewable energy resources to meet five percent of the total power demand by 2015 and ten percent by 2020”*

**Source:** POWER DIVISION MINISTRY OF POWER, ENERGY AND MINERAL RESOURCES GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH. (2008). *RENEWABLE ENERGY POLICY OF BANGLADESH*.

[https://policy.asiapacificenergy.org/sites/default/files/REP\\_English.pdf](https://policy.asiapacificenergy.org/sites/default/files/REP_English.pdf)

Accessed: 2025-02-19

### 2.2 Guidelines for the implementation of solar power development program - 2013

*Note: The implementation year of this target is uncertain. It is possible that the target was set earlier than 2013.*

In the document from 2013 Bangladesh targets 500 MW installed capacity of solar power for 2015.

**Exact mention:**

*“...government has targeted to generate 500 MW of solar power by 2015.”*

**Source:**

POWER DIVISION MINISTRY OF POWER, ENERGY AND MINERAL RESOURCES  
GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH. (2013). *Guidelines  
for the implementation of solar power development program - 2013*.

Accessed: 2025-05-06

### **2.3 Mujib climate prosperity plan**

In 2022 the Ministry of Environment, Forest and Climate Change Government of the People's Republic of Bangladesh created the Mujib climate prosperity plan 2022-2041: "Building forward stronger by charting a decade of investment towards realizing robust inclusive socioeconomic development that fully integrates resilience and low carbon economic green growth for optimized prosperity and economic partnerships towards 2041".

In the plan, Bangladesh targeted 15% renewable electricity generation (assumption: RES incl.hydro) for 2030 and 40% renewable electricity generation (assumption: RES incl.hydro) for 2041. (In this project, these targets are assumed to be regarding electricity generation. However, they could possibly be targeting electricity supply).

**Exact quote:** "With international and other investment support, we hope to reach 30% renewable energy by 2030 and up to 40% by 2041, with grid resilience and modernization."

**Source:** Ministry of Environment, Forest and Climate Change Government of the People's Republic of Bangladesh. (2022). *Mujib climate prosperity plan 2022-2041*.

[https://moef.portal.gov.bd/sites/default/files/files/moef.portal.gov.bd/publications/f6c2ae73\\_30eb\\_4174\\_9adb\\_022323da1f39/Mujib%20Climate%20Prosperity%20Plan%202022-2041.pdf](https://moef.portal.gov.bd/sites/default/files/files/moef.portal.gov.bd/publications/f6c2ae73_30eb_4174_9adb_022323da1f39/Mujib%20Climate%20Prosperity%20Plan%202022-2041.pdf)

Accessed: 2025-02-19

## **3 Belgium**

### **3.1 NREAP - Renewable Energy Projections as Published in the National Renewable Energy Action Plans of the European Member States**

The Renewable Energy Directive (2009/28/EC)<sup>1</sup> addresses various subjects related to the development of renewable energies in the European Member States, among others the legally binding share of renewable energy in gross final energy consumption. In Article 4 of the Directive each Member State is requested to provide a National Renewable Energy Action Plan (NREAP) by 30 June 2010. Several countries updated their plans in 2011.

#### **3.1.1 Gross final electricity consumption**

In the NREAP report from 2011, Belgium targets 20.9% gross final electricity consumption (RES-E, assumption including hydro) for 2020. The RES-E target for 2020 is also mentioned as 1988 ktoe, which was converted to 23.12044 TWh (Unit Juggler, n.d.).

### 3.1.4 Gross final energy consumption

In the same report published 2011 Belgium targeted 13% renewable gross final energy consumption for 2020.

### 3.1.2 Electricity generation

Belgium also targeted renewable electricity generation for 2020. The targets used for this project were:

- 10,474 TWh windpower (subtotal)
- 1,139 TWh solar power.

### Exact mention:

EN-E-10-069

	2005					2010					2015					2020					Proj	
	[GWh]	[base]	[%] <sup>a</sup>	[%] <sup>b</sup>	[%] <sup>c</sup>	[GWh]	[base]	[%] <sup>a</sup>	[%] <sup>b</sup>	[%] <sup>c</sup>	[GWh]	[base]	[%] <sup>a</sup>	[%] <sup>b</sup>	[%] <sup>c</sup>	[GWh]	[base]	[%] <sup>a</sup>	[%] <sup>b</sup>	[%] <sup>c</sup>		
Renewable Electricity production	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	75
Hydropower < 10 MW	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	75
Hydropower 10 MW	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	75
Hydropower (subtotal)	350	30	52.2	4.3	0.4	362	30	7.8	2.0	0.4	391	34	3.0	1.1	0.4	440	38	1.9	0.7	0.4	0.1	75
Geothermal	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	82
Solar photovoltaic	1	0	0.1	0.0	0.0	304	26	6.5	1.7	0.3	610	52	4.7	1.7	0.6	1139	98	4.9	1.8	1.0	0.2	93
Concentrated solar power	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	93
Solar (subtotal)	1	0	0.1	0.0	0.0	304	26	6.5	1.7	0.3	610	52	4.7	1.7	0.6	1139	98	4.9	1.8	1.0	0.2	93
Total, wind and ocean energy	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	100
Onshore wind	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	111
Offshore wind	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	111
Wind power (subtotal)	320	27	47.6	3.9	0.3	691	85	21.2	5.6	1.0	1424	127	10.7	3.8	1.3	1674	141	6.5	2.4	1.3	0.2	111
Solid biomass	1521	111	226.7	18.6	1.7	2380	222	55.3	14.6	2.6	3535	442	39.5	14.3	5.0	5975	823	41.4	15.3	8.6	2.0	127
Biogas	218	20	75.0	2.9	0.3	391	34	8.4	2.2	0.4	777	67	6.0	2.2	0.8	1819	124	6.2	2.3	1.3	0.3	121
Bioaliquids	35	3	5.2	0.4	0.0	34	3	0.7	0.2	0.0	30	3	0.2	0.1	0.0	25	2	0.1	0.0	0.0	0.0	121
Biomass (subtotal)	1791	134	206.9	21.9	1.9	3064	259	64.5	17.0	3.1	4682	542	45.7	16.5	5.8	7829	949	47.7	17.7	10.0	2.3	121
Total (according to Template Tables 10a,b)	671	58	100.0	8.2	0.7	4664	401	100.0	24.4	4.4	13037	1121	100.0	36.2	12.7	23121	1988	100.0	37.0	20.9	4.8	-
Sum of all technologies (Template Tables 10a,b)	2462	212	366.9	30.2	2.7	4664	401	100.0	28.4	4.8	13037	1121	100.0	36.2	12.7	23121	1988	100.0	37.0	20.9	4.8	-
Gross final RES-E consumption (Template Table 4a)	212	367.4	30.2	2.7	0.8	401	100.0	28.4	4.8	1.0	1121	100.0	36.2	12.7	2.7	1988	100.0	37.0	20.9	4.8	64-67	
Geothermal	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	126
Solar biomass	3	0.7	0.5	0.0	0.0	29	3.8	1.9	0.1	0.1	91	6.4	2.9	0.4	0.2	109	7.2	3.3	0.9	0.5	122	
Solid biomass	476	96.9	67.7	2.2	1.2	669	87.3	44.0	3.1	1.7	1138	79.3	36.2	8.9	4.7	1947	75.2	36.2	8.9	4.7	140	
Biogas	2	0.4	0.3	0.0	0.0	9	1.2	0.6	0.0	0.0	26	1.8	0.8	0.1	0.1	55	2.1	1.0	0.1	0.1	140	
Bioaliquids	0	0.0	0.0	0.0	0.0	4	0.5	0.3	0.0	0.0	14	1.0	0.5	0.1	0.0	12	1.2	0.6	0.1	0.1	140	
Biomass (subtotal)	477	97.3	68.0	2.2	1.2	682	89.0	44.9	3.1	1.7	1178	82.1	38.0	5.4	2.9	2004	78.6	37.8	9.1	4.9	140	
Geothermal heat pumps	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	146
Geothermal heat pumps	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	146
Hydrothermal heat pumps	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	146
Renewable energy from heat pumps (subtotal)	7	1.4	1.0	0.0	0.0	52	6.8	3.4	0.2	0.1	183	11.3	5.2	0.7	0.4	300	13.5	6.5	1.6	0.8	146	
Total (according to Template Table 11)	491	100.0	69.9	2.3	1.3	766	100.0	50.4	3.5	1.9	1435	100.0	46.3	6.6	3.5	2588	100.0	48.2	11.9	6.3	-	
Sum of all technologies (Template Table 11)	491	100.0	69.9	2.3	1.3	766	100.0	50.4	3.5	1.9	1435	100.0	46.3	6.6	3.5	2588	100.0	48.2	11.9	6.3	-	
Gross final RES-E consumption (Template Table 4a)	491	100.0	69.9	2.3	1.3	766	100.0	50.4	3.5	1.9	1435	100.0	46.3	6.6	3.5	2588	100.0	48.2	11.9	6.3	64-67	
Biogas	0	0.0	0.0	0.0	0.0	37	10.5	2.4	0.4	0.1	47	8.6	1.5	0.5	0.1	91	10.3	1.7	1.0	0.2	152	
Hydrogen from renewables	0	0.0	0.0	0.0	0.0	787	87.7	10.7	1.1	0.7	688	87.8	14.4	4.8	1.1	688	78.8	13.0	1.0	0.7	158	
Hydrogen from non-renewables	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	162	
Renewable electricity	16	100.0	2.3	0.2	0.0	29	8.8	1.8	0.3	0.1	47	8.8	1.5	0.5	0.1	97	10.8	1.8	1.1	0.2	172	
Other fuels	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	180	
Total (according to Template Table 12)	16	100.0	2.3	0.2	0.0	351	100.0	23.2	3.8	0.9	544	100.0	17.6	5.8	1.3	886	100.0	16.5	10.1	2.1	-	
Sum of all technologies (Template Table 12)	16	100.0	2.3	0.2	0.0	351	100.0	23.2	3.8	0.9	544	100.0	17.6	5.8	1.3	886	100.0	16.5	10.1	2.1	-	
Gross final RES-E consumption (Template Table 4a)	16	100.0	2.3	0.2	0.0	351	100.0	23.2	3.8	0.9	544	100.0	17.6	5.8	1.3	886	100.0	16.5	10.1	2.1	64-67	
RES-E including Article 17 (Template Table 4b) <sup>d</sup>	16	100.0	2.3	0.2	0.0	351	100.0	23.2	3.8	0.9	544	100.0	17.6	5.8	1.3	886	100.0	16.5	10.1	2.1	64-67	
All RES excl. co-operation mech.	702	100.0	8.3	1.8	1.4	1520	100.0	16.3	3.8	3.096	100.0	33.3	7.5	5.774	100.0	61.5	13.0	64-67	64-67			
Transfer from other Member States and third countries	248	78.1	6.5	1.4	1.06	90.4	16.1	1.7	3.053	98.6	33.8	7.4	5.855	99.8	61.4	11.0	-	-	-	-	64-67	
Transfer to other Member States	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	64-67	
All RES incl. co-operation mech.	702	100.0	8.3	1.8	1.4	1520	100.0	16.3	3.8	3.096	100.0	33.3	7.5	5.774	100.0	61.5	13.0	64-67	64-67			
Electricity	7912	8670	100.0	20.7	8.29	8371	100.0	20.7	8.428	9428	100.0	21.5	9.526	100.0	23.1	53	-	-	-	-	53	
Heating and cooling	21804	21804	100.0	57.1	21.804	21804	100.0	57.8	21.804	21804	100.0	57.8	21.804	100.0	57.8	55	-	-	-	-	-	54
Transport	8493	8493	100.0	22.2	9485	9304	100.0	23.0	42057	42057	100.0	23.7	8760	100.0	21.2	56	-	-	-	-	-	55
Total before aviation reduction	38209	38209	100.0	60.0	40157	40157	100.0	61.0	41076	41076	100.0	61.0	41301	100.0	59	-	-	-	-	-	-	56
Total after aviation reduction	38209	38209	100.0	60.0	40157	40157	100.0	61.0	41076	41076	100.0	61.0	41301	100.0	59	-	-	-	-	-	-	56
Additional energy efficiency <sup>e</sup>	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	60
Additional energy efficiency <sup>f</sup>	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	61
Transport fuels target	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	62
Overall renewable target	2.2	2.2	100.0	0.0	0.0	4.4	4.4	100.0	0.0	0.0	7.1	7.1	100.0	0.0	0.0	10.0	-	-	-	-	-	47

<sup>a</sup> The percentages refer to the values in the column "Base" and express the share of the renewable technology in the sector total (RES-E, RES-HC or RES-S, see values highlighted in bold).  
<sup>b</sup> The percentages refer to the values in the column "Base" and express the share of the renewable technology in total RES (if applicable including co-operation mechanisms, see values highlighted in bold).  
<sup>c</sup> The percentages refer to the values in the column "Base" and express the share of the renewable technology in the sector total of the final gross energy consumption (Additional energy efficiency scenario) only, see values highlighted in bold.  
<sup>d</sup> The percentages refer to the values in the column "Base" and express the share of the renewable technology in the total final gross energy consumption (before aviation reduction of the Additional energy efficiency scenario), see values highlighted in bold.  
<sup>e</sup> Art. 17.2 adjustment refers to double counting of

**Source:** European Environment Agency, 2011. *Renewable Energy Projections as Published in the National Renewable Energy Action Plans of the European Member States.*

[https://www.eea.europa.eu/en/analysis/maps-and-charts/national-renewable-energy-action-plan/nreap\\_draft\\_report\\_eea-ecm\\_20100830.pdf/@@download/file](https://www.eea.europa.eu/en/analysis/maps-and-charts/national-renewable-energy-action-plan/nreap_draft_report_eea-ecm_20100830.pdf/@@download/file)

Accessed 2025-02-17

### **3.2 NECP - National Energy and Climate Plan**

The National Energy and Climate Plan (NECP) is the national strategic guidance tool that integrates energy and climate policy with a time horizon of 2030, in accordance with national and European legislation.

#### **3.2.1 Installed capacity**

In the NECP report from 2019 Belgium targets 4 GW offshore wind for 2030.

#### **3.2.2 Electricity generation**

In the NECP report from 2021 Belgium targeted renewable electricity generation for both 2025 and 2030. The targets used in this project are the following:

- 1340,5 ktoe windpower for 2025. (Converted to 15,590015 TWh).
- 604,4 ktoe solar Power for 2025. (Converted to 7,029 TWh).
- 2102,3 ktoe wind power for 2030. (Converted to 24,449749 TWh).
- 836,7 ktoe solar Power for 2030. (Converted to 9,730821 TWh).

Converting units was done with (Unit Juggler, n.d.).

#### **3.2.3 Gross final electricity consumption**

In the NECP report Belgium targeted 2347,7 ktoe renewable gross final electricity consumption for 2025 (RES-E, including hydro) as well as 3269,5 ktoe renewable gross final electricity consumption for 2030 (RES-E, including hydro). These targets were converted to 27,30 TWh as well as 38,024 TWh using (Unit Juggler, n.d.).

## Exact mention:

Lastly, the following table shows the development in RES by technology in the WAM scenario.

(ktoe)	2015	2020	2025	2030
<b>RES-E</b>	<b>1,199.3</b>	<b>2,049.0</b>	<b>2,347.7</b>	<b>3,269.5</b>
Hydro	28.4	31.7	35.2	38.6
Wind	434.8	1,162.9	1,340.5	2,102.3
Solar PV	262.5	387.5	604.4	836.7
Biomass	473.6	466.9	367.6	291.9
<b>RES-T</b>	<b>288.7</b>	<b>717.2</b>	<b>933.9</b>	<b>983.6</b>
RES elec road	0.2	12.3	43.8	118.3
RES elec rail	33.9	34.7	45.5	64.7
Biofuels	254.6	670.2	844.6	800.6
<b>RES-H&amp;C</b>	<b>1,432.5</b>	<b>1,515.7</b>	<b>1,781.8</b>	<b>2,071.6</b>
Biomass	1,343.5	1,393.1	1,529.4	1,665.3
Derived heat	48.6	36.1	75.3	116.1
Heat pumps	40.4	86.5	177.1	290.2

Table from page 18.

**Source:** European commission. (2019). *National Energy and Climate Plan*

[https://energy.ec.europa.eu/system/files/2020-09/be\\_final\\_necp\\_partb\\_en\\_0.pdf](https://energy.ec.europa.eu/system/files/2020-09/be_final_necp_partb_en_0.pdf)

### 3.3 Summary of the Commission assessment of the draft National Energy and Climate Plan 2021-2030

In 2021 Belgium targeted an 18,3% share of energy from renewable sources in gross final energy consumption in 2030.

**Exact mention:** “Belgium proposes an 18,3% share of energy from renewable sources in gross final consumption of energy in 2030 as contribution to the EU renewable energy target for 2030.”

**Source:** European Commission. (n.d). *Summary of the Commission assessment of the draft National Energy and Climate Plan 2021-2030*

[https://energy.ec.europa.eu/document/download/d8bb4490-c556-4851-bcec-fd5af92e3901\\_en](https://energy.ec.europa.eu/document/download/d8bb4490-c556-4851-bcec-fd5af92e3901_en)

## 4 Ireland

### 4.1 EU Renewable Electricity Directive (2001/77/EC)

Directive 2001/77/EC is a European Union Directive for promoting renewable energy use in electricity generation. It is popularly known as the RES Directive. The directive, which took effect in October 2001, sets national indicative targets for renewable energy production from individual member states.

In the EU directive from 2001, the Member States' national indicative targets for the contribution of electricity produced from renewable energy sources to gross electricity

consumption by 2010 is stated. For Ireland, a target of 13,2% gross final electricity consumption is stated.

**Exact mention:**

	RES-E TWh 1997 (**)	RES-E % 1997 (***)	RES-E % 2010 (***)
Belgium	0,86	1,1	6,0
Denmark	3,21	8,7	29,0
Germany	24,91	4,5	12,5
Greece	3,94	8,6	20,1
Spain	37,15	19,9	29,4
France	66,00	15,0	21,0
Ireland	0,84	3,6	<b>13,2</b>

Table from page 7 in the document.

**Source:** European Parliament & Council of the European Union. (2001). *Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market*. Official Journal of the European Communities, L 283/33.

<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32001L0077&from=en>

Accessed: 2025-02-14

**4.2 White Paper on Energy Policy 2007 (IEA)**

*Note: The official document is linked and referenced in many articles and reports, but have been deleted from the government's official site.*

4.2.1 Gross final electricity consumption

Building on the energy "Green Paper" (an EU energy strategy) and related consultation process conducted during 2006, the Irish government released an energy "White Paper" in March 2007. This paper sets out a national energy policy framework for the years 2007 to 2020. In the paper, it is described that Ireland targets 15% gross final electricity consumption (assumption: RES incl hydro) for 2010 and 33% gross final electricity consumption (assumption: RES incl hydro) for 2020.

4.2.2 Installed capacity

An additional target of 500 MW installed capacity of ocean energy for 2020 is also described.

**Exact mention:** *“achieving 15% of electricity consumption from renewable sources by 2010 through existing and new projects under the REFIT Scheme; and- achieving 33% of electricity consumption from renewable sources by 2020 through support for research, development, commercialisation and technology transfer and planning for offshore wind, ocean technology and biomass. ...setting an initial ambition of at least 500MW of installed*

ocean energy capacity by 2020;- supporting further long-term developments of offshore wind projects...”

**Source:** Irish Energy association, IEA. (2012). *White paper: Delivering a sustainable Energy Future for Ireland.*

<https://www.iea.org/policies/4560-white-paper-delivering-a-sustainable-energy-future-for-ireland>

Accessed: 2025-02-15

### 4.3 Sustainable energy authority of Ireland - RENEWABLE ENERGY IN IRELAND 2020 Update

*Note: This document is not a policy itself but describes relevant targets for 2020 and how close Ireland was to achieving them in 2018. The targets collected from this report are understood to have been an increase from the EU White paper 2007 targets under the EU Renewable Energy Directive (2009/28/EC). The RES target is also confirmed by the EU directive.*

The Sustainable Energy Authority of Ireland is Ireland’s national energy authority, investing in and delivering appropriate, effective and sustainable solutions to help Ireland’s transition to a clean energy future. We work with the Government, homeowners, businesses and communities to achieve this, through expertise, funding, educational programmes, policy advice, research and the development of new technologies. SEAI is funded by the Government of Ireland through the Department of Communications, Climate Action and Environment. SEAI is the official source of energy data for Ireland.

#### 4.3.1 Gross final energy consumption

In 2009, Ireland targeted 16% gross final energy consumption (RES incl hydro) for 2020. This target is a binding EU target as a result from the Renewable Energy Directive 2009/28/EC.

**Table 1: Progress towards renewable energy targets<sup>7</sup>, 2000 to 2018**

Progress towards target %	2000	2005	2010	2015	2016	2017	2018	2020 target
RES-T (with weighting factors)	0.0	0.0	2.5%	5.9	5.2	7.4	7.2	10.0
RES-H	2.4	3.4	4.3	6.2	6.3	6.7	6.5	12.0
RES-E (normalised)	4.8	7.2	15.6	25.5	26.8	30.1	33.2	40.0
<b>Overall RES</b>	<b>1.9</b>	<b>2.8</b>	<b>5.7</b>	<b>9.1</b>	<b>9.2</b>	<b>10.5</b>	<b>11.0</b>	<b>16.0</b>

Source: SEAI

Table from the SEAI report, page 9.

#### 4.3.2 Gross final electricity consumption

In 2009, Ireland targeted 40% gross final electricity consumption (RES-E incl hydro) for 2020. This is a national target, but was set in order to achieve the EU-binding RES target.

**Exact mention:** “Ireland’s 2020 national target for renewable electricity is 40% of gross electricity consumption, but there is no specified mandatory EU RES-E target for 2020.” (note that this is just an example, the report mentions this target several times)

**Source:** Sustainable energy authority of Ireland, SEAI. (2020). *Renewable energy in Ireland 2020 update*.

Accessed: 2025-02-17

#### **4.4 NREAP - Renewable Energy Projections as Published in the National Renewable Energy Action Plans of the European Member States**

*Note: In Ireland's National Renewable Energy action plan several targets were set from 2011 to 2020 (as seen in the table below). The values for 2005 and 2010 are baseline values, the values for 2015 are calculated estimations, therefore these values are not recorded as targets.*

The Renewable Energy Directive (2009/28/EC)<sup>1</sup> addresses various subjects related to the development of renewable energies in the European Member States, among others the legally binding share of renewable energy in gross final energy consumption. In Article 4 of the Directive each Member State is requested to provide a National Renewable Energy Action Plan (NREAP) by 30 June 2010. Several countries updated their plans in 2011.

##### 4.4.1 Electricity generation

In the NREAP Ireland targets 701 GWh Hydropower (subtotal), 230GWh ocean, tidal and wave energy, 10228 GWh onshore wind power, 1742 GWh offshore wind power (11970 GWh wind power subtotal), 687 GWh solid biomass, 319 GWh biogas (1006 biomass subtotal).

##### 4.4.2 Gross final electricity consumption

The total target in gross final electricity consumption (RES-E) is also mentioned; 1196 ktoe or 42,5%.

	2005					2010					2015					2020					Page				
	[GWh]	[ktce]	[%]¹	[%]²	[%]³	[GWh]	[ktce]	[%]¹	[%]²	[%]³	[GWh]	[ktce]	[%]¹	[%]²	[%]³	[GWh]	[ktce]	[%]¹	[%]²	[%]³					
Renewable Electricity	Hydropower < 10 MW	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	75			
reduction	Hydropower 10-100 MW	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	75			
	Hydropower > 100 MW	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	75			
	Hydropower (subtotal)	760	65	20.8	17.5	2.8	701	60	12.0	7.0	2.4	6.5	714	61	2.2	4.4	2.3	6.5	701	60	2.2	4.4	71		
	Geothermal	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	82			
	Solar photovoltaic	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	91			
	Concentrated solar power	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	91			
	Solar (subtotal)	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	91			
	Tidal, wave and ocean energy	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	100			
	Onshore wind	n.a.	n.a.	0.0	0.0	0.0	4701	404	801	471	16.3	3.1	7325	647	75.7	46.4	34.5	4.8	10726	878	73.5	38.8	31.3	111	
	Offshore wind	n.a.	n.a.	0.0	0.0	0.0	116	10	2.0	1.2	0.4	0.1	814	70	8.2	5.0	2.7	0.5	1742	150	12.5	6.6	5.3	1.1	
	Wind power (subtotal)	1588	137	64.4	36.6	5.8	4817	414	821	482	16.7	3.2	8339	717	83.9	51.4	27.2	5.3	11070	1029	86.1	45.4	36.6	7.1	
	Solid biomass	8	1	0.3	0.2	0.0	28	2	0.5	0.3	0.1	0.0	567	49	5.7	3.5	1.8	0.4	687	59	2.6	2.6	2.1	0.4	
	Biogas	108	9	4.4	2.5	0.4	0.1	320	28	5.5	3.2	1.1	0.2	320	28	3.2	1.0	0.2	319	27	2.3	1.2	0.0	0.2	
	Biofuels	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0		
	Biomass (subtotal)	116	10	4.7	2.7	0.4	0.1	347	30	5.9	3.5	1.2	0.2	887	76	8.9	5.5	2.9	0.6	1006	87	7.2	3.8	3.1	0.6
	Total (according to Template Tables 10(a,b))	2465	212	100.0	56.8	9.1	1.7	5866	504	100.0	58.1	20.4	3.9	9949	855	100.0	61.3	32.4	6.3	13900	1196	100.0	52.7	42.5	8.5
	Sum of all technologies (Template Tables 10(a,b))	2464	212	100.0	56.8	9.1	1.7	5865	504	100.0	58.1	20.4	3.9	9948	855	100.0	61.3	32.4	6.3	13900	1196	100.0	52.7	42.5	8.5
	Gross final RES-E consumption (Template Table 4a)	180	94.9	48.3	7.7	1.4	0	304	99.9	58.7	20.4	3.9	9949	855	100.0	61.3	32.4	6.3	13900	1196	100.0	52.7	42.5	8.5	
Heating and cooling	Geothermal	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	126			
	Solar thermal	0	0	0.0	0.0	0.0	0	4	1.8	0.5	0.1	0.0	12	2.7	0.9	0.2	0.1	20	3.4	0.9	0.4	0.1	132		
	Solid biomass	176	91.2	47.2	3.2	1.4	188	85.3	21.9	3.6	1.4	362	80.3	26.0	7.1	2.7	453	76.6	20.0	9.2	3.2	140			
	Biogas	7	3.6	1.9	0.1	0.1	10	4.5	1.2	0.2	0.1	26	5.8	1.9	0.5	0.2	33	5.6	1.5	0.7	0.2	140			
	Biofuels	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	140			
	Biomass (subtotal)	183	94.8	49.1	3.3	1.4	198	90.0	23.1	3.8	1.5	388	86.0	27.8	7.7	2.9	486	88.2	21.4	9.9	3.4	140			
	Aerothermal heat pumps	n.a.	n.a.	0.0	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	146			
	Geothermal heat pumps	n.a.	n.a.	0.0	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	146			
	Hydrothermal heat pumps	n.a.	n.a.	0.0	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	146			
	Renewable energy from heat pumps (subtotal)	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0	0	0.0	0.0	0.0	146			
	Total (according to Template Table 11)	193	100.0	51.7	3.5	1.5	220	100.0	25.6	4.3	1.7	451	100.0	32.4	8.9	3.3	591	100.0	26.0	12.0	4.2	-			
	Sum of all technologies (Template Table 11)	193	100.0	51.7	3.5	1.5	220	100.0	25.6	4.3	1.7	451	100.0	32.4	8.9	3.3	590	99.8	26.0	12.0	4.2	-			
	Gross final RES-E consumption (Template Table 4a)	193	100.0	51.7	3.5	1.5	220	100.0	25.6	4.3	1.7	451	100.0	32.4	8.9	3.3	591	100.0	26.0	12.0	4.2	64-67			
Transport	Bioethanol / bio-ETBE	0	0	0.0	0.0	0.0	0	29.6	4.7	0.9	0.3	90	30.0	6.3	1.7	0.7	139	28.8	6.1	2.4	1.0	132			
	Bioisobutanol	1	1	0.0	0.3	0.0	0.0	94	69.6	10.9	2.1	0.7	209	69.7	14.0	4.1	1.5	342	71.0	15.1	6.0	2.4	138		
	Hydrogen from renewables	n.a.	n.a.	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	162			
	Renewable electricity	1	1	0.0	0.3	0.0	0.0	1	0.7	0.1	0.0	0.0	1	0.3	0.1	0.0	0.0	37	7.7	1.6	0.6	0.3	172		
	Other biofuels	1	1	0.0	0.3	0.0	0.0	1	0.7	0.1	0.0	0.0	1	0.3	0.1	0.0	0.0	1	0.2	0.0	0.0	0.0	180		
	Total (according to Template Table 12)	1	1	0.0	0.3	0.0	0.0	115	100.0	15.7	3.0	1.0	300	100.0	21.5	5.8	2.2	482	100.0	21.2	8.4	3.4	-		
	Sum of all technologies (Template Table 12)	3	3	0.0	0.8	0.1	0.0	136	100.7	15.8	3.0	1.0	301	100.3	21.6	5.8	2.2	519	107.7	23.9	9.0	3.7	-		
	Gross final RES-E consumption (Template Table 4a)	1	1	0.0	0.3	0.0	0.0	135	100.0	15.7	3.0	1.0	300	100.0	21.5	5.8	2.2	482	100.0	21.2	8.4	3.4	64-67		
	RES-E including Article 17.2 (Template Table 4b)¹	1	1	0.0	0.3	0.0	0.0	138	102.2	16.1	3.0	1.1	304	101.3	21.8	5.9	2.2	575	119.3	25.3	10.0	4.1	64-67		
All RES excl. co-operation mech.	Gross final RES consumption (Template Table 4a)	373	100.0	9.5	2.9	2.9	859	100.0	18.8	6.6	6.6	1605	115.1	31.2	11.8	2209	100.0	39.5	16.0	6.0	6.0	64-67			
	Sum of all technologies (Template Table 4a)	405	100.0	10.6	3.2	3.2	858	99.9	18.8	6.6	6.6	1605	115.1	31.1	11.8	2232	100.0	39.4	15.8	5.8	5.8	64-67			
	Sum of all technologies in Template Tables 10(a,b), 11, 12	408	100.0	10.4	3.2	3.2	860	100.0	18.8	6.6	6.6	1607	115.1	31.2	11.8	2205	100.0	39.5	16.0	6.0	6.0	64-67			
Cooperation mechanisms	Transfer from other Member States and third countries	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	64-67			
	Transfer to other Member States	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	64-67			
All RES incl. co-operation mech.	Total (Template Table 4a)	373	100.0	9.5	2.9	2.9	859	100.0	18.8	6.6	6.6	1605	100.0	27.1	10.3	2269	100.0	39.5	16.0	6.0	6.0	64-67			
Final consumption	Electricity	2341	100.0	18.3	2473	2511	2164	2037	2037	19.4	2636	100.0	19.4	2813	2037	19.4	2813	2037	19.4	2813	2037	32			
	reference scenario²	5516	100.0	43.1	5184	5180	5388	5388	43.1	5388	100.0	37.3	5724	4931	34.9	54	54	54	54	54	54	54			
	additional energy efficiency³	3912	100.0	30.5	4605	4605	5311	5311	30.5	5311	100.0	38.0	5747	4931	34.9	54	54	54	54	54	54	54			
	reference scenario²	12607	100.0	130.4	13227	13227	14181	14181	130.4	14181	100.0	135.75	15367	14142	100.0	100.0	100.0	100.0	100.0	100.0	100.0	58			
	additional energy efficiency³	12607	100.0	130.4	13227	13227	14181	14181	130.4	14181	100.0	135.75	15367	14142	100.0	100.0	100.0	100.0	100.0	100.0	100.0	59			
	Total before aviation reduction	12741	100.0	131.06	13106	13106	14181	14181	131.06	14181	100.0	136.81	15367	14142	100.0	100.0	100.0	100.0	100.0	100.0	100.0	60			
	reference scenario²	12741	100.0	131.06	13106	13106	14181	14181	131.06	14181	100.0	136.81	15367	14142	100.0	100.0	100.0	100.0	100.0	100.0	100.0	60			
	additional energy efficiency³	12741	100.0	131.06	13106	13106	14181	14181	131.06	14181	100.0	136.81	15367	14142	100.0	100.0									

In 2023 the Government of Ireland adopted the Climate action plan 2023 Changing Ireland for the better. In the plan Ireland targeted 80% renewable gross final electricity consumption (assumption including hydro) for 2030.

#### 4.5.2 Installed capacity

In 2021 Ireland targeted 6 GW installed capacity from onshore wind and up to 5 GW from solar power by 2025.

In 2023 Ireland targeted 9 GW installed capacity from onshore wind, 8 GW from solar power, and at least 5 GW installed capacity from offshore wind energy by 2030.

#### Exact mention:

*“Among the most important measures in the plan is to increase the proportion of renewable electricity to 80% by 2030 and a target of 9 GW from onshore wind, 8 GW from solar, and at least 5 GW of offshore wind energy by 2030.” (page 17)*

*“Climate Action Plan 2021 and this Climate Action Plan. Factoring in the additional measures from Climate Action Plan 2021 results in a projected decrease in GHG emissions of 33.2% relative to 2018 levels. These projections assume significant reductions in key sectors such as power generation, residential buildings, transport, commercial and public services, and agriculture; with full and early implementation of existing policy commitments including by 2030: • achieving at least 70% of electricity demand from renewable sources...” (page 31)*

#### Key Targets

Target	2025	2030
Renewable Electricity Share	50%	80%
Onshore Wind	6 GW	9 GW
Solar	Up to 5 GW	8 GW
Offshore Wind	-	At least 5 GW
New Flexible Gas Plant	-	At least 2 GW
Demand Side Flexibility	15-20%	20-30%

Table from page 129.

**Source:** Government of Ireland. (2023). *CLIMATE ACTION PLAN 2023 CAP23 Changing Ireland for the better.*

Accessed: 2025-02-17

#### 4.6 Future Framework for Offshore Renewable Energy (government of Ireland)

In 2024 Ireland's minister for the Environment, Climate and Communications and Minister for Transport Eamon Ryan launched the ‘Future Framework’ for offshore wind energy. The framework long-term model and vision for offshore renewable energy in Ireland. It targets 20 GW installed capacity of offshore wind by 2040 and 37 GW installed capacity of offshore wind by 2050.

20 GW installed capacity offshore wind 2040

37 GW installed capacity offshore wind 2050

**Exact mention:** *“The Future Framework is the long-term model and vision for offshore renewable energy in Ireland. It sets out the pathway Ireland will take to deliver 20GW of offshore wind by 2040 and at least 37GW in total by 2050.”*

**Source:** Department of the Environment, Climate and Communications, (2024). *Minister Ryan launches consultation on the ‘Future Framework’ for offshore wind energy.*

<https://www.gov.ie/en/press-release/30809-minister-ryan-launches-consultation-on-the-future-framework-for-offshore-wind-energy/>

Accessed: 2025-02-17

## 5 Israel

For all the following sources communicating Israel’s renewable energy targets the same assumption is made. The assumption is that when targeting general renewable energy targets for all energy sources, it is excluding hydropower (RES excl.hydro). This is based on the document Renewable Energy in Israel - Background. (Ministry of Finance, 2021) that states “The State of Israel, alongside countries around the world, is encouraging a shift toward renewable energy utilizing sources such as solar radiation, wind power, biomass and additional non-fossil energy sources. This shift is based upon the understanding that fossil fuels are a finite resource while renewables will enable continuous, long term, environmentally friendly power generation. The target sources of renewable energy in the Israeli market are solar, wind and waste/refuse based generation systems.” The assumption is further strengthened by a passage in the updated NDC report from 2021 (ClimateWatch, 2021) that states: “Electricity generation has been largely based on domestic and imported fossil fuels as Israel has no access to a number of widely used low-carbon sources of energy such as nuclear, hydro-electric and geothermal power.”

### 5.1 Renewable Energy in Israel - Background

#### 5.1.1 Electricity supply share

In 2002 Israel targeted a 2% renewable Electricity supply share for 2007, the country also targeted 5% renewable Electricity supply share for 2016 as well as 10% renewable Electricity supply share for 2020.

**Exact mention:** *“In 2002, the Ministers' Committee on Social and Economical Affairs decided, in resolution 2246 - 44/כח, to encourage construction and operation of electricity plants and power stations operated by renewable energies by private electricity producers and the electricity company. The resolution set a goal of 2% of the electricity supply to consumers starting from 2007 and an increase of one percent every three years, up to a level of 5% of the total electricity generation in 2016 and of 10% up to 2020.”*

*Note: The target was interpreted as energy supply by the line “The resolution set a goal of 2% of the electricity supply to consumers”. The base year of the following targets is 2002. We assume that the supply in this case is the same as the electricity generation.*

### 5.1.2 Electricity generation share

In 2009 Israel targeted 5% renewable electricity generation share for 2014 as well as 10% for 2020. In 2015 Israel targeted 13% renewable electricity generation share for 2025 as well as 17% for 2030.

**Exact mention:** *“The following resolution 4450 set a guiding target of electricity generation from renewable energy at a 10% rate of the energy needs of the State in 2020 and called for acting to build renewable energy based power stations in the Negev and Arava region, in an annual capacity of 250 MW at least. In addition, an interim target was defined for generating 5% of the electricity consumption through renewable energies up to 2014.”*, *“In September 2015, a government resolution (Resolution 542) was adopted on reducing greenhouse gas levels and making energy consumption in the economy more efficient, inter alia by producing electricity from renewable energy sources at a rate of 13% in 2025, out of Israel's total electricity consumption, and 17% in 2030.”*

*Note: It was assumed that the mentioned target of 5% was of the same type as previously mentioned target of electricity generation share. It was assumed that generation share was the same as the consumption share as it mentioned producing electricity from renewable energy sources.*

**Source:** Ministry of Finance. 2021-01-26. *Renewable Energy in Israel - Background*.  
[https://www.gov.il/en/pages/project-renewable-energy-ag?\\_\\_cf\\_chl\\_tk=JSMEY0xWZy6Z37hs2q\\_D8eRtigrTfUwQYnaarII6uWE-1742804474-1.0.1.1-QGL.ecXvqyIgbk.LRupYrsjejxc4yXgQxm3SE58R.bA](https://www.gov.il/en/pages/project-renewable-energy-ag?__cf_chl_tk=JSMEY0xWZy6Z37hs2q_D8eRtigrTfUwQYnaarII6uWE-1742804474-1.0.1.1-QGL.ecXvqyIgbk.LRupYrsjejxc4yXgQxm3SE58R.bA)

Accessed: 2025-03-24

## 5.2 Promoting renewable energy in the electricity sector and amending government decisions

*Note: This source's original language was Hebrew. To interpret it Google Translate was used, this may increase the risk of misinterpretations. It was assumed that “electricity production” in this source referenced electricity generation share.*

In 2020 Israel targeted a 20% share of renewable electricity generation for 2025 as well as 30% for 2030.

**Exact mention:** *“1.The Government notes the decision of the Minister of Energy on the policy principles according to which by 2030 30% of electricity production will be from renewable energy, mainly solar-based and partly wind-based, and decides to accordingly update the targets for production from renewable energy set out in Government Decision No.*

*542 of 20.09.2015 (hereinafter – Decision 542) on the subject of “Reducing greenhouse gas emissions and streamlining energy consumption in the economy”*

*2. Further to Decision 542, the Government determines an update to the interim target, so that it will stand at 20% by 31.12.2025.”.*

**Source:** Prime Minister's Office. 2020-10-25. *Promoting renewable energy in the electricity sector and amending government decisions* [https://www.gov.il/he/pages/dec465\\_2020](https://www.gov.il/he/pages/dec465_2020)

Accessed: 2025-03-25

## **6 Netherlands**

### **6.1 EU directive 2001/77/EC**

Directive 2001/77/EC is a European Union Directive for promoting renewable energy use in electricity generation. It is popularly known as the RES Directive. The directive, which took effect in October 2001, sets national indicative targets for renewable energy production from individual member states.

In the EU directive from 2001, the Member States' national indicative targets for the contribution of electricity produced from renewable energy sources to gross electricity consumption by 2010 is stated. For the Netherlands, a target of 9,0% gross final electricity consumption (RES-E, assumption: including hydro) is stated)

**Exact mention:**

	RES-E TWh 1997 (**)	RES-E % 1997 (***)	RES-E % 2010 (***)
Belgium	0,86	1,1	6,0
Denmark	3,21	8,7	29,0
Germany	24,91	4,5	12,5
Greece	3,94	8,6	20,1
Spain	37,15	19,9	29,4
France	66,00	15,0	21,0
Ireland	0,84	3,6	13,2
Italy	46,46	16,0	25,0 (†)
Luxembourg	0,14	2,1	5,7 (†)
Netherlands	3,45	3,5	9,0

Table from page 7.

**Source:** European Parliament & Council of the European Union. (2001). *Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market*. Official Journal of the European Communities, L 283/33.

<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32001L0077&from=en>

Accessed: 2025-02-14

## 6.2 EU Directive 2009/28/EC

In the EU Renewable energy directive from 2009 a national target for gross final energy consumption (RES, assumption including hydro) in 2020 is set as 14% for the Netherlands.

**Exact mention:**

A. National overall targets

	Share of energy from renewable sources in gross final consumption of energy, 2005 (S <sub>2005</sub> )	Target for share of energy from renewable sources in gross final consumption of energy, 2020 (S <sub>2020</sub> )
Belgium	2,2 %	13 %
Bulgaria	9,4 %	16 %
Czech Republic	6,1 %	13 %
Denmark	17,0 %	30 %
Germany	5,8 %	18 %
Estonia	18,0 %	25 %
Ireland	3,1 %	16 %
Greece	6,9 %	18 %
Spain	8,7 %	20 %
France	10,3 %	23 %
Italy	5,2 %	17 %
Cyprus	2,9 %	13 %
Latvia	32,6 %	40 %
Lithuania	15,0 %	23 %
Luxembourg	0,9 %	11 %
Hungary	4,3 %	13 %
Malta	0,0 %	10 %
Netherlands	2,4 %	14 %

Table from page 31

**Source:** European Parliament & Council of the European Union. (2009). *Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC*. Official Journal of the European Communities, L 140/16.

<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0028&qid=1743077656138>

Accessed: 2025-02-17

### 6.3 NREAP - Renewable Energy Projections as Published in the National Renewable Energy Action Plans of the European Member States

*Note: The Netherland's National Renewable Energy action plan was submitted in 2010 but put in action in 2011. The values for 2005 and 2010 are baseline values, the values for 2015 are calculated estimations, therefore these values are not recorded as targets.*

The Renewable Energy Directive (2009/28/EC)<sup>1</sup> addresses various subjects related to the development of renewable energies in the European Member States, among others the legally binding share of renewable energy in gross final energy consumption. In Article 4 of the

Directive each Member State is requested to provide a National Renewable Energy Action Plan (NREAP) by 30 June 2010. Several countries updated their plans in 2011.

### 6.3.1 Electricity generation

In the NREAP Netherland targets 714 GWh electricity generation for hydropower (subtotal) for 2020, as well as 570 GWh electricity generation from solar power, 13372 GWh from onshore wind, 19036 GWh from offshore wind (32408 GWh wind power subtotal) and 16639 GWh from biomass (subtotal).

- Hydro: 714 GWh = 0,714 TWh
- Solar: 570 GWh = 0,57 TWh
- Onshore wind: 13372 GWh = 13,372 TWh
- Offshore wind: 19036 GWh = 19,036 TWh
- Wind: 32408 GWh = 32,408 TWh
- Biomass: 16639 GWh = 16,639 TWh

### 6.3.2 Gross final electricity consumption

The total target in gross final electricity consumption (RES-E, assumption including hydro) consumption is also mentioned; 4326 ktoe. This is converted to 50.31138 TWh (Unit Juggler, n.d.).

The target is also mentioned as a share, 37% gross final electricity consumption (RES-E assumption including hydro) for 2020.

### Exact mention:

		2005					2010					2015					2020					Page				
		[GWh]	[ktoe]	[%] <sup>1</sup>	[%] <sup>2</sup>	[%] <sup>3</sup>	[GWh]	[ktoe]	[%] <sup>1</sup>	[%] <sup>2</sup>	[%] <sup>3</sup>	[GWh]	[ktoe]	[%] <sup>1</sup>	[%] <sup>2</sup>	[%] <sup>3</sup>	[GWh]	[ktoe]	[%] <sup>1</sup>	[%] <sup>2</sup>	[%] <sup>3</sup>					
Renewable production	Electricity																									
		n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	75			
		n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	75			
		n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	75			
		89	8	1.2	0.6	0.1	0.0	128	11	1.2	0.5	0.1	0.0	200	17	0.7	0.4	0.2	0.0	714	61	1.4	0.8	0.5	0.1	75
		n.a.	n.a.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	82	
		0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	82
		40	3	0.6	0.3	0.0	0.0	73	6	0.7	0.3	0.1	0.0	250	21	0.9	0.5	0.2	0.0	570	49	1.1	0.7	0.4	0.1	83
		0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	83
		40	3	0.6	0.3	0.0	0.0	73	6	0.7	0.3	0.1	0.0	250	21	0.9	0.5	0.2	0.0	570	49	1.1	0.7	0.4	0.1	83
		0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	100
		0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	111
	2067	178	28.6	13.3	1.7	0.3	3667	315	34.5	14.8	3.0	0.6	9508	818	34.6	19.0	7.3	1.6	13372	1150	26.6	15.7	9.8	2.2	111	
	0	0	0.0	0.0	0.0	0.0	903	69	7.5	3.2	0.6	0.1	4147	357	15.1	8.3	3.2	0.7	19036	1637	37.8	22.3	14.0	3.1	111	
	2067	178	28.6	13.3	1.7	0.3	4470	384	42.0	18.1	3.6	0.8	13655	1174	49.8	27.3	10.5	2.3	32408	2787	64.4	38.0	23.9	5.3	111	
	4758	409	65.8	30.6	4.0	0.8	5103	439	48.0	20.6	4.1	0.9	11189	962	40.8	22.3	8.6	1.9	11975	1030	23.8	14.0	8.8	2.0	121	
	283	24	3.9	1.8	0.2	0.0	972	75	8.2	3.5	0.7	0.1	2161	186	7.9	4.3	1.7	0.4	4664	401	9.3	5.5	3.4	0.8	121	
	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	121	
	5941	433	69.7	32.4	4.2	0.8	5975	514	56.2	24.1	4.8	1.0	13350	1148	48.6	26.7	10.2	2.2	16639	1431	33.1	19.5	12.2	2.7	121	
	7233	622	100.0	46.4	6.0	1.2	10636	915	100.0	43.0	8.6	1.8	27442	2360	100.0	54.8	21.0	4.6	50317	4326	100.0	58.9	37.0	8.3	-	
	7237	622	100.1	46.5	6.0	1.2	10646	915	100.1	43.0	8.6	1.8	27455	2361	100.0	54.8	21.1	4.6	50331	4328	100.0	59.0	37.0	8.3	-	
	622	100.0	46.5	6.0	1.2	915	100.1	43.0	8.6	1.8	2360	100.0	54.8	21.1	4.6	4326	100.0	58.9	37.0	8.3	4326	100.0	58.9	37.0	8.3	64-67
	0	0.0	0.0	0.0	0.0	0.0	39	4.3	1.8	0.2	0.1	130	9.4	3.8	0.5	0.3	259	11.9	3.5	1.0	0.5	1.0	0.5	1.0	126	
	16	2.2	1.2	0.1	0.0	0.0	20	2.2	0.9	0.1	0.0	17	1.2	0.4	0.1	0.0	23	1.1	0.3	0.1	0.0	0.0	0.0	0.0	132	
	540	75.3	40.3	1.9	1.0	0.0	573	63.2	26.9	2.3	1.1	604	43.8	14.0	2.5	1.2	650	29.8	8.9	2.6	1.2	1.40	1.40	1.40	1.40	140
	69	9.6	5.2	0.2	0.1	0.0	111	12.3	5.2	0.5	0.2	174	12.6	4.0	0.7	0.3	208	13.2	3.9	1.2	0.6	1.40	1.40	1.40	1.40	140
	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	140	
	58	5.3	2.8	0.1	0.1	0.0	31	3.4	1.5	0.1	0.1	202	14.6	4.7	0.8	0.4	282	26.7	7.9	2.3	1.1	1.40	1.40	1.40	1.40	140
	647	90.2	48.3	2.3	1.2	0.0	715	78.9	33.6	2.9	1.4	980	71.0	22.8	4.0	1.9	1520	69.8	20.7	6.1	2.9	1.40	1.40	1.40	1.40	140
	n.a.	0.0	0.0	0.0	0.0	0.0	35	3.9	1.6	0.1	0.1	81	5.9	1.9	0.3	0.2	117	5.4	1.6	0.5	0.2	1.46	1.46	1.46	1.46	146
	n.a.	0.0	0.0	0.0	0.0	0.0	90	9.9	4.2	0.4	0.2	161	11.7	3.7	0.7	0.3	242	11.1	3.3	1.0	0.5	1.46	1.46	1.46	1.46	146
	n.a.	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	3	0.2	0.1	0.0	0.0	11	0.5	0.1	0.0	0.0	1.46	1.46	1.46	1.46	146
	54	7.5	4.0	0.2	0.1	0.0	132	14.6	6.2	0.5	0.3	252	19.3	5.9	1.0	0.5	377	17.3	5.1	1.5	0.7	1.46	1.46	1.46	1.46	146
	717	100.0	53.5	2.5	1.3	0.0	906	100.0	42.6	3.7	1.8	1380	100.0	32.0	5.6	2.7	2179	100.0	29.7	8.7	4.2	-	-	-	-	146
	717	100.0	53.5	2.5	1.3	0.0	906	100.0	42.6	3.7	1.8	1379	99.9	32.0	5.6	2.7	2179	100.0	29.7	8.7	4.2	-	-	-	-	146
	717	100.0	53.5	2.5	1.3	0.0	906	100.0	42.6	3.7	1.8	1380	100.0	32.0	5.6	2.7	2179	100.0	29.7	8.7	4.2	-	-	-	-	64-67
	0	0.0	0.0	0.0	0.0	0.0	168	52.7	7.9	1.4	0.3	217	36.7	5.0	1.9	0.4	282	31.2	3.8	2.7	0.5	152	152	152	152	152
	0	0.0	0.0	0.0	0.0	0.0	139	43.6	6.5	1.2	0.3	350	39.2	8.1	3.1	0.7	352	61.0	7.5	5.2	1.1	158	158	158	158	158
	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	162	162	162	162	162
	8	100.0	0.6	0.1	0.0	0.0	12	3.8	0.6	0.1	0.0	23	3.9	0.5	0.2	0.0	71	7.8	1.0	0.7	0.1	172	172	172	172	172
	n.a.	0.0	0.0	0.0	0.0	0.0	n.a.	0.0	0.0	0.0	0.0	n.a.	0.0	0.0	0.0	0.0	n.a.	0.0	0.0	0.0	0.0	180	180	180	180	180
	8	100.0	0.6	0.1	0.0	0.0	319	100.0	15.0	2.7	0.6	591	100.0	13.7	5.2	1.1	905	100.0	12.3	8.5	1.7	-	-	-	-	180
	8	100.0	0.6	0.1	0.0	0.0	319	100.0	15.0	2.7	0.6	590	99.8	13.7	5.2	1.1	905	100.0	12.3	8.5	1.7	-	-	-	-	180
	8	100.0	0.6	0.1	0.0	0.0	319	100.0	15.0	2.7	0.6	591	100.0	13.7	5.2	1.1	905	100.0	12.3	8.5	1.7	-	-	-	-	64-67
	8	100.0	0.6	0.1	0.0	0.0	475	148.9	22.3	4.1	0.9	685	115.9	15.9	6.0	1.3	1097	121.2	14.9	10.3	2.1	-	-	-	-	64-67
	1339	100.0	11.8	2.5	1.2	0.0	2128	100.0	18.2	4.2	0.0	4307	100.0	37.7	8.3	0.0	7340	100.0	69.0	14.1	0.0	-	-	-	-	64-67
	1339	100.0	11.8	2.5	1.2	0.0	2128	100.0	18.2	4.2	0.0	4308	100.0	37.7	8.3	0.0	7339	100.0	69.0	14.1	0.0	-	-	-	-	64-67
	1347	100.0	11.9	2.5	1.2	0.0	2140	100.0	18.3	4.2	0.0	4330	100.0	37.9	8.4	0.0	74									

**Source:** European Environment Agency, 2011. *Renewable Energy Projections as Published in the National Renewable Energy Action Plans of the European Member States.*

[https://www.eea.europa.eu/en/analysis/maps-and-charts/national-renewable-energy-action-plan/nreap\\_draft\\_report\\_eea-ecm\\_20100830.pdf/@@download/file](https://www.eea.europa.eu/en/analysis/maps-and-charts/national-renewable-energy-action-plan/nreap_draft_report_eea-ecm_20100830.pdf/@@download/file)

Accessed: 2025-02-17

#### **6.4 NECP - National Energy and Climate Plan**

The National Energy and Climate Plan (NECP) is the national strategic guidance tool that integrates energy and climate policy with a time horizon of 2030, in accordance with national and European legislation.

In the Netherlands updated NECP-report, the country 2023 targeted 39% renewable gross final energy consumption (RES, assumption including hydro) for 2030. This target was later restated in the final version of the NECP report from 2024. This target is in contribution to the binding EU RES target of 42,5%.

**Exact mention:** *“On 20 November 2023, the revised Renewable Energy Directive was endorsed with an increase in the European target of 42.5 % renewable energy. The indicative target for the Netherlands is 39 % in 2030. The deadline for national implementation started with the entry into force of the Directive.”*

**Source:** Ministry of Economic Affairs and Climate Policy. (2023). *Draft Update of the National Plan Energy and Climate 2021-2030.*

Accessed: 2025-04-01

#### **6.5 Clean energy for EU islands, Factsheet: the Netherlands (NECP)**

*Note: In the official NECP the target mentioned below is not included, only the RES target of 39% is mentioned there. The RES-E has been collected from this EU document that states that the target is set in the NECP report from the Netherlands.*

The National Energy and Climate Plan (NECP) is the national strategic guidance tool that integrates energy and climate policy with a time horizon of 2030, in accordance with national and European legislation.

In the EU document it is stated that the Netherlands targeted 74,4% renewable gross final electricity consumption (RES-E, assumption including hydro) in 2023 for 2030.

**Exact mention:**

*“The Dutch government aims for 16% of all energy used in the Netherlands to be sustainable by 2023. The Integrated National Energy and Climate Plan for the Netherlands for the period 2021-2030 sets the target for renewable energy in the electricity sector at 74.4% for 2030. Targets for renewable energy in heating and cooling have not been mentioned.”*

**Source:** European Commission. (2022). *Clean energy for EU islands, STATE-OF-PLAY INVENTORY OF LEGISLATION AND REGULATION FOR CLEAN ENERGY ON EUROPEAN ISLANDS Factsheet: The Netherlands.*

<https://clean-energy-islands.ec.europa.eu/system/files/2022-02/Netherlands%20Factsheet.pdf>

Accessed: 2025-04-01

## 7 Nigeria

### 7.1 Renewable Energy Master Plan

In Nigeria's masterplan from 2005, the country targets installed capacity from renewable energy sources for 2007, 2015 and 2025. The targets extracted for the project were the following:

- 5 MW solar power for 2007.
- 120 MW solar power for 2015.
- 500 MW solar power for 2025.
- 1 MW wind power for 2007.
- 20 MW wind power for 2015.
- 40 MW wind power for 2025.

#### Exact mention:

*“Targets For Electricity Generation(MW)”*

Table 3.2.2: Targets For Electricity Generation(MW)

Sources	2007	2015	2025
Wind	1	20	40
Solar PV	5	120	500
Solar thermal	-	1	5
Small hydro	50	600	2000
Biomass	-	100	800
<b>Total</b>	<b>56</b>	<b>841</b>	<b>3345</b>
ECN High Growth Scenario Projections	7000	14000	29000
Percentage share of projected energy demand	0.8	6	11.53

Table from page 122.

*Note: In the document “Electricity generation” is used to describe the targets, however the unit used is watt witch indicates that the country actually targets installed capacity. For the project the targets were assumed to be in installed capacity. Solar is represented by the ‘Solar PV’ values from the table.*

**Source:**

Energy Commission of Nigeria & United Nations Development Programme. (2005). *Renewable Energy Master Plan*.

<https://www.iceednigeria.org/resources/nov.-2005.pdf>

Accessed: 2025-04-17

## 7.2 Renewable Electricity Action Program (REAP)

### 7.2.1 Installed capacity

In the program from 2006 Nigeria targeted renewable installed capacity for 2007, 2010 and 2016. The targets extracted for the project were the following:

- 10 MW solar power for 2007.
- 20 MW solar power for 2010.
- 130 MW solar power for 2016.
- 0 MW wind power for 2007.
- 20 MW wind power for 2010.
- 100 MW wind power for 2016.

**Exact mention:** “*Renewable energy targets for Nigeria's electricity sector, MW, based on Peak Demand*”

<b>Table: 3.0 Renewable energy targets for Nigeria's electricity sector, MW, based on Peak Demand</b>			
	<b>2007</b>	<b>2010</b>	<b>2016</b>
FMPs Projections	7,000	10,000	15,000
Small Hydro	50	100	400
Solar PV	10	20	130
Wind	0	20	100
Bagasse Cogeneration	0	15	105
<b>Total Renewables, MW</b>	<b>60</b>	<b>155</b>	<b>735</b>
<b>% Total</b>	<b>1</b>	<b>2</b>	<b>5</b>

Table from page 52

*Note: Solar is represented by the ‘Solar PV’ values from the table.*

### 7.2.2 Installed capacity share

In the same report from 2006 Nigeria targets a total share of installed capacity from renewable energy sources (RES incl. hydro). Nigeria targets a 30% share renewable installed capacity for 2016.

**Exact mention:** *The Federal Government of Nigeria sets the following 10-year targets for the contribution of renewable electricity to the economy (2007 – 2016): 5% contribution to total electricity generating capacity, excluding large hydropower.<sup>2</sup> 2) Together with large hydro, the renewable content of electricity generation will be about 30%. (page 52)*

*Note: The source assigned was RES including hydropower and therefore the value from the footnote in the exact mention was used.*

**Source:**

Federal Ministry of Power and Steel, Federal Republic of Nigeria. (2006). *Renewable Electricity Action Program (REAP)*. Page 52.

<https://www.iceednigeria.org/resources/dec.-2006-2.pdf>

Accessed: 2025-04-17

### **7.3 National Renewable Energy and Energy Efficiency policy (NREEEP)**

#### **7.3.1 Installed capacity**

*Note: Because of the units used, the targets were assumed to be regarding installed capacity despite the terminology used in the document.*

In 2015 Nigeria targeted an increase in renewable installed capacity in the form of several renewable energy sources. In the report the country targeted the following:

- 5 MW biomass for 2015.
- 57,4 MW biomass for 2020.
- 291,92 MW biomass for 2030.
- 117 MW solar power for 2015.
- 1343,17 MW solar power for 2020.
- 6830,97 MW solar power for 2030.
- 2261 MW hydropower for 2015.
- 6156,22 MW hydropower for 2020.
- 12800,77 MW hydropower for 2030.
- 55 MW wind power for 2015.
- 631,41 MW wind power for 2020.
- 3211,14 MW wind power for 2030.
- 2438 MW for the total renewable energy sources (RES including hydro) for 2015.
- 8188,2 MW for the total renewable energy sources (RES including hydro) for 2020.
- 23134,8 MW for the total renewable energy sources (RES including hydro) for 2030.

**Exact mention:**

**Table 5.5.5: Summary of Renewable Electricity Targets**

S/N	Resource	2012	Short Term (2015)	Medium Term (2020)	Long Term (2030)
1	Hydro (LHP)	1,938.00	2,121.00	4,549.00	4,626.96
2	Hydro (SHP)	60.18	140.00	1,607.22	8,173.81
3	Solar	15	117.00	1,343.17	6,830.97
4	Biomass	-	55.00	631.41	3,211.14
5	Wind	10	50.00	57.40	291.92
	All Renewables plus LHP	1,985.18	2,438.00	8,188.20	23,134.80
	All Energy Resources(On-grid power plus 12,500MW of self-generated power)	21200**	24,380**	45,490**	115,674**
	% of Renewables plus LHP	23%	10%	18%	20%
	% RE Less LHP	0.80%	1.30%	8%	16%

\*From Supply projections based on 7% GDP Growth

\*\*Supply projections are based on the addition of on-grid power, and a base capacity of 12,500MW of self-generation (i.e. power generated for own use) including off-grid

Table from page 36

**Table 5.3.2: Biomass Programme Targets**

S/N	Activity/Item	Timeline/Quantity		
		Short Term (2015)	Medium Term (2020)	Long Term (2030)
1	Biomass Electricity(MW)	5.0	57	292
2	Biofuel (ML/day)*			
	- Bio ethanol (E10)	5.3	9.7	24.2
	- Biodiesel (B20)	2.0	3.4	11.7

\*Based on 7% Growth rate Supply Projections of PMS and AGO

Table from page 35

**Table 5.3.3:Solar Electricity Programme Targets**

S/N	Activity/Item	Timeline/Quantity		
		Short Term (2015)	Medium Term (2020)	Long Term (2030)
1	Solar (All PV and Solar Thermal Systems inclusive)	117	1,343	6,831

Table from page 35

**Table 5.3.1: Hydropower Programme Targets**

S/N	Activity/Item	Timeline/Quantity		
		Short Term (2015)	Medium Term (2020)	Long Term (2030)
1	Large Hydropower (MW)	2,121	4,549	4,627
2	Small Hydropower (MW)	140	1,607	8,174
	Total (MW)	2,261	6,156	12,801

Table from page 35

**Table 5.3.4: Wind Programme Targets**

S/N	Activity/Item	Timeline/Quantity		
		Short Term (2015)	Medium Term (2020)	Long Term (2030)
1	Wind Electricity (MW)	55	631	3,211
2	Windmill Water Pumping Systems (No.)	20	100	200

Table from page 36

*Note: It seems that the values for wind power and biomass got mixed up in table 5.5.5. Therefore the values from table 5.3.2 were assumed to be correct, and the values written under windpower in table 5.5.5 were used for biomass (with the exception of the value of 2015 which seems to be 5 MW in table 5.3.2 and 50 MW in table 5.5.5, so then 5 MW was used since that table seemed the most correct). The values written under biomass in table 5.5.5 were used for wind power. In this case solar power refers to all solar PV and solar thermal systems as stated in the table. For hydropower, the targets consists of the sum of small and large hydropower. The values in table 5.5.5 stated as “All Renewables plus LHP” (LHP means large hydropower) were extracted, and the source assigned to these data points was “RES (incl.hydro)”.*

### 7.3.2 Installed capacity share

*Note: Because of the units used, the targets were assumed to be regarding installed capacity despite the terminology used in the document.*

In the NREEEP report from 2015, Nigeria targeted a 10% renewable installed capacity share for all renewable sources (RES including hydro) for 2015, an 18% share for 2020 as well as a 20% share for 2030.

**Exact mention:** See Table 5.5.5 shown above.

*Note: Here the values in table 5.5.5 stated as “% of Renewables plus LHP” (LHP means large hydropower) were extracted, and the source assigned to these data points was “RES (incl.hydro)”.*

**Source:**

Ministry of Power Federal Republic of Nigeria. (2015). *National renewable energy and energy efficiency policy (NREEEP)*.

[https://cdn.climatepolicyradar.org/navigator/NGA/2015/national-renewable-energy-and-energy-efficiency-policy-nreeep\\_90a8d0bc8092cfe4f72e1a3e09faccd7.pdf](https://cdn.climatepolicyradar.org/navigator/NGA/2015/national-renewable-energy-and-energy-efficiency-policy-nreeep_90a8d0bc8092cfe4f72e1a3e09faccd7.pdf)

Accessed: 2025-04-18

## **7.4 Sustainable Energy For All Action Agenda (SE4ALL-AA)**

The SE4ALL-AA contains targets set in 2016 for the future. In general for this document the target-values were extracted from table 7 & 8, which are shown below. Especially values for 2020 and 2030 were extracted. Also, only the values that were on-grid data were used.

### 7.4.1 Electricity generation

In 2016 Nigeria implemented targets for renewable electricity generation for 2020 and 2030. The targets chosen for this report were the following:

- 3283 GWh solar power for 2020.
- 8208 GWh solar power for 2030.
- 397 GWh wind power for 2020.
- 1866 GWh wind power for 2030.
- 20031 GWh electricity generation from all renewable energy sources (RES incl.hydro) for 2020.
- 49766 GWh electricity generation from all renewable energy sources (RES incl.hydro) for 2030.

*Note: The targets were assumed to refer to electricity generation. “Solar power” in this case refers to “Solar PV” in the source. “Sub total RE plus” was extracted from the table from page 37 and assumed to represent all renewable energy sources including large hydropower, it is therefore used as “RES incl.hydro” in the project.*

### 7.4.2 Installed capacity

In the report from 2016 Nigeria targeted the following for installed capacity in the form of renewable energy sources for 2020 as well as 2030:

- 2000 MW solar power for 2020.
- 5000 MW solar power for 2030.
- 170 MW wind power for 2020.
- 800 MW wind power for 2030.
- 5325 MW installed capacity in the form of renewable energy sources (RES incl.hydro) for 2020.

- 13800 MW installed capacity in the form of renewable energy sources (RES incl.hydro) for 2030.

*Note: Solar refers to the ‘Solar PV’ values. The values for wind were extracted from the line stating ‘Wind (Max)’. The values representing RES (incl. hydro) were extracted from the line stating ‘Sub total RE plus LHP’, since it was assumed that it meant renewable sources including large hydropower.*

### 7.4.3 Electricity generation share

In 2016 Nigeria targeted a 38% share of renewable electricity generation from all renewable energy sources (RES incl.hydro) for 2020 as well as a 29% share for 2030.

*Note: The values representing RES (incl. hydro) were extracted from the line stating ‘% RE plus LHP’, since it was assumed that it meant renewable sources including large hydropower.*

### 7.4.4 Installed capacity share

In 2016 Nigeria targeted a 52% share of renewable installed capacity in the form of all renewable energy sources (RES incl.hydro) for 2020 as well as a 43% share for 2030.

*Note: The values representing RES (incl. hydro) were extracted from the line stating ‘% RE plus LHP’, since it was assumed that it meant renewable sources including large hydropower.*

### Exact mention: “Electricity Vision 30-30-30 Capacity Growth Projection (MW)”

**Table 7: Electricity Vision 30-30-30 Capacity Growth Projection (MW)**

ELECTRICITY VISION: 30 30 30																	
EDY	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
<b>ON-GRID CAPACITY - MWH</b>																	
<b>Fossil Fuel (FF)</b>																	
Gas	2,800	3,076	3,121	3,913	4,372	4,259	4,524	4,867	5,286	5,889	6,684	7,581	8,646	9,714	10,957	12,429	13,000
Coal	0	0	0	0	0	255	424	628	871	1,060	1,203	1,408	1,582	1,958	2,388	2,846	3,200
Nuclear	0	0	0	0	0	0	0	0	0	0	0	1,000	1,000	1,000	1,500	1,500	2,000
<b>Sub Total FF</b>	<b>2,800</b>	<b>3,076</b>	<b>3,121</b>	<b>3,913</b>	<b>4,372</b>	<b>4,514</b>	<b>4,948</b>	<b>5,495</b>	<b>6,157</b>	<b>6,949</b>	<b>7,887</b>	<b>8,989</b>	<b>11,228</b>	<b>12,672</b>	<b>14,845</b>	<b>16,775</b>	<b>18,200</b>
<b>Renewables (RE)</b>																	
LHP	916	1,097	1,200	1,650	1,920	2,200	2,540	2,800	3,100	3,400	3,700	4,000	4,200	4,500	4,600	4,700	4,700
SMHP	0	15	45	125	205	285	365	445	525	605	685	765	845	925	1,005	1,085	1,165
Solar PV	0	0	100	500	1,200	1,600	2,000	2,300	2,600	2,900	3,200	3,500	3,840	4,180	4,520	4,860	5,000
Solar Thermal	0	0	0	0	0	0	50	200	300	400	500	600	700	800	900	950	1,000
Wind (Max)	0	0	10	50	90	130	170	210	250	290	330	370	450	530	610	750	800
Biomass	0	0	0	50	180	240	300	360	420	480	540	600	720	840	960	1,080	1,100
Geothermal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Sub Total RE plus LHP</b>	<b>916</b>	<b>1,112</b>	<b>1,355</b>	<b>2,375</b>	<b>3,595</b>	<b>4,455</b>	<b>5,325</b>	<b>6,195</b>	<b>7,075</b>	<b>7,955</b>	<b>8,835</b>	<b>9,695</b>	<b>10,615</b>	<b>11,635</b>	<b>12,455</b>	<b>13,285</b>	<b>13,800</b>
<b>Sub Total RE less LHP</b>	<b>0</b>	<b>15</b>	<b>155</b>	<b>775</b>	<b>1,675</b>	<b>2,255</b>	<b>2,785</b>	<b>3,395</b>	<b>3,975</b>	<b>4,555</b>	<b>5,135</b>	<b>5,695</b>	<b>6,415</b>	<b>7,135</b>	<b>7,855</b>	<b>8,585</b>	<b>9,100</b>
<b>% RE plus LHP</b>	<b>25</b>	<b>27</b>	<b>30</b>	<b>38</b>	<b>46</b>	<b>50</b>	<b>52</b>	<b>53</b>	<b>53</b>	<b>53</b>	<b>53</b>	<b>49</b>	<b>49</b>	<b>48</b>	<b>46</b>	<b>44</b>	<b>43</b>
<b>% RE less LHP</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>12</b>	<b>22</b>	<b>25</b>	<b>27</b>	<b>29</b>	<b>30</b>	<b>31</b>	<b>31</b>	<b>29</b>	<b>29</b>	<b>29</b>	<b>29</b>	<b>29</b>	<b>28</b>
<b>TOTAL ON-GRID (FF+RE) - MWH</b>	<b>3,716</b>	<b>4,188</b>	<b>4,476</b>	<b>6,288</b>	<b>7,767</b>	<b>8,969</b>	<b>10,273</b>	<b>11,690</b>	<b>13,232</b>	<b>14,904</b>	<b>16,722</b>	<b>19,684</b>	<b>21,843</b>	<b>24,307</b>	<b>27,300</b>	<b>30,060</b>	<b>32,000</b>
<b>OFF-GRID CAPACITY - MWH</b>																	
Mini-Grid	1	1	5	50	125	150	180	270	405	608	911	1,367	2,050	3,075	3,691	4,429	5,314
SHS+ Street Lights	10	30	50	300	350	300	360	540	648	778	933	1,120	1,344	1,612	1,935	2,322	2,786
<b>TOTAL OFF-GRID - MWH</b>	<b>11</b>	<b>31</b>	<b>55</b>	<b>350</b>	<b>475</b>	<b>450</b>	<b>540</b>	<b>810</b>	<b>1,053</b>	<b>1,385</b>	<b>1,844</b>	<b>2,487</b>	<b>3,394</b>	<b>4,687</b>	<b>5,625</b>	<b>6,751</b>	<b>8,101</b>
<b>SELF GENERATION (CAPTIVE)</b>	<b>13,800</b>	<b>13,800</b>	<b>12,500</b>	<b>12,000</b>	<b>11,500</b>	<b>11,000</b>	<b>10,500</b>	<b>10,000</b>	<b>9,500</b>	<b>9,000</b>	<b>8,500</b>	<b>8,000</b>	<b>7,500</b>	<b>7,000</b>	<b>6,500</b>	<b>6,000</b>	<b>5,000</b>
<b>GRAND TOTAL - MWH</b>	<b>17,527</b>	<b>18,019</b>	<b>17,031</b>	<b>18,438</b>	<b>19,542</b>	<b>20,419</b>	<b>21,313</b>	<b>22,500</b>	<b>23,785</b>	<b>25,290</b>	<b>27,067</b>	<b>30,170</b>	<b>32,737</b>	<b>35,995</b>	<b>39,426</b>	<b>42,811</b>	<b>45,101</b>

**30GW BY 2030 WITH 30% RENEWABLE ENERGY**

Table from page 36

“Electricity Vision: 30-30-30 Energy Delivery Projections (GWH)”

Table 8: Electricity Vision: 30-30-30 Energy Delivery Projections (GWH)

ELECTRICITY VISION: 30-30-30																	
EOY	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
<b>ON-GRID CAPACITY - GWH</b>																	
<b>Fossil Fuel (FF)</b>																	
Gas	18,386	20,198	20,494	25,696	27,397	27,967	29,708	31,956	34,710	38,672	43,893	49,777	56,774	63,787	71,951	81,616	85,363
Coal	0	0	0	0	0	1,674	2,784	4,124	5,719	6,960	7,899	9,245	10,388	12,857	15,681	18,688	21,203
Nuclear	0	0	0	0	0	0	0	0	0	0	0	7,776	7,776	7,776	11,664	11,664	15,552
<b>Sub Total FF</b>	<b>18,386</b>	<b>20,198</b>	<b>20,494</b>	<b>25,696</b>	<b>27,397</b>	<b>29,641</b>	<b>32,493</b>	<b>36,080</b>	<b>40,429</b>	<b>45,633</b>	<b>51,792</b>	<b>66,798</b>	<b>74,938</b>	<b>84,420</b>	<b>99,296</b>	<b>111,968</b>	<b>122,118</b>
<b>Renewables (RE)</b>																	
LHP	4,749	5,687	6,221	8,554	9,953	11,405	13,167	14,515	16,070	17,626	19,181	20,736	21,773	23,328	23,846	24,365	24,365
SMHP	0	78	233	648	1,063	1,477	1,374	1,685	2,100	2,514	2,929	3,240	3,655	4,069	4,484	4,899	6,221
Solar PV	0	0	164	821	1,970	2,627	3,283	3,776	4,268	4,761	5,253	5,746	6,304	6,862	7,420	7,978	8,208
Solar Thermal	0	0	0	0	0	151	605	907	1,210	43,272	1,814	2,117	2,419	2,722	2,873	3,024	3,024
Wind	0	0	23	117	210	303	397	490	583	677	770	863	1,050	1,236	1,423	1,750	1,866
Biomass	0	0	0	276	995	1,327	1,659	1,991	2,322	2,654	2,986	3,318	3,981	4,645	5,308	5,972	6,083
Geothermal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Sub Total RE plus</b>	<b>4,749</b>	<b>5,765</b>	<b>6,642</b>	<b>10,418</b>	<b>14,191</b>	<b>17,139</b>	<b>20,031</b>	<b>23,061</b>	<b>26,251</b>	<b>29,441</b>	<b>74,391</b>	<b>35,717</b>	<b>38,879</b>	<b>42,560</b>	<b>45,204</b>	<b>47,838</b>	<b>49,766</b>
<b>Sub Total RE less</b>	<b>0</b>	<b>78</b>	<b>421</b>	<b>1,862</b>	<b>4,238</b>	<b>5,734</b>	<b>6,864</b>	<b>8,545</b>	<b>10,181</b>	<b>11,815</b>	<b>55,210</b>	<b>14,981</b>	<b>17,106</b>	<b>19,232</b>	<b>21,357</b>	<b>23,471</b>	<b>25,402</b>
<b>% RE plus LHP</b>	<b>21</b>	<b>22</b>	<b>24</b>	<b>29</b>	<b>34</b>	<b>37</b>	<b>38</b>	<b>39</b>	<b>39</b>	<b>39</b>	<b>59</b>	<b>35</b>	<b>34</b>	<b>34</b>	<b>31</b>	<b>30</b>	<b>29</b>
<b>% RE less LHP</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>5</b>	<b>10</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>44</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>
<b>TOTAL ON-GRID (FF+RE) - GWH</b>	<b>23,134</b>	<b>25,963</b>	<b>27,135</b>	<b>36,111</b>	<b>41,588</b>	<b>46,780</b>	<b>52,523</b>	<b>59,141</b>	<b>66,680</b>	<b>75,073</b>	<b>126,183</b>	<b>102,515</b>	<b>113,817</b>	<b>126,980</b>	<b>144,499</b>	<b>159,804</b>	<b>171,885</b>
<b>OFF-GRID CAPACITY - GWH</b>																	
Mini-Grid	1	2	9	864	2,160	2,592	3,110	4,666	6,998	10,498	15,746	23,620	35,429	53,144	63,773	76,528	91,833
SHS + Street Lights	17	52	86	173	259	518	622	933	1,120	1,344	1,612	1,935	2,322	2,786	3,344	4,012	4,815
<b>TOTAL OFF-GRID - MW</b>	<b>18</b>	<b>54</b>	<b>95</b>	<b>1,037</b>	<b>2,419</b>	<b>3,110</b>	<b>3,732</b>	<b>5,599</b>	<b>8,118</b>	<b>11,841</b>	<b>17,359</b>	<b>25,555</b>	<b>37,751</b>	<b>55,930</b>	<b>67,116</b>	<b>80,540</b>	<b>96,648</b>
<b>SELF GENERATION (CAPTIVE) - GWH</b>	<b>90,616</b>	<b>90,616</b>	<b>82,080</b>	<b>78,797</b>	<b>75,514</b>	<b>72,230</b>	<b>68,947</b>	<b>65,664</b>	<b>62,381</b>	<b>59,098</b>	<b>55,814</b>	<b>52,531</b>	<b>49,248</b>	<b>45,965</b>	<b>42,682</b>	<b>39,398</b>	<b>32,832</b>
<b>GRAND TOTAL -</b>	<b>113,769</b>	<b>116,633</b>	<b>109,310</b>	<b>115,945</b>	<b>119,521</b>	<b>122,121</b>	<b>125,203</b>	<b>130,404</b>	<b>137,179</b>	<b>146,012</b>	<b>199,356</b>	<b>180,601</b>	<b>200,816</b>	<b>228,875</b>	<b>254,297</b>	<b>279,742</b>	<b>301,364</b>
<b>Real Per Capita (kWh)</b>	<b>136</b>	<b>145</b>	<b>143</b>	<b>191</b>	<b>221</b>	<b>245</b>	<b>269</b>	<b>302</b>	<b>341</b>	<b>386</b>	<b>622</b>	<b>541</b>	<b>625</b>	<b>736</b>	<b>831</b>	<b>920</b>	<b>1,003</b>
<b>Per Capita (kWh) including Self Generation</b>	<b>669</b>	<b>648</b>	<b>574</b>	<b>597</b>	<b>601</b>	<b>599</b>	<b>599</b>	<b>609</b>	<b>625</b>	<b>649</b>	<b>864</b>	<b>763</b>	<b>828</b>	<b>921</b>	<b>998</b>	<b>1,071</b>	<b>1,126</b>
<b>Population Growth (Million) at 2% Ave Rate</b>	<b>170.00</b>	<b>180.00</b>	<b>190.34</b>	<b>194.15</b>	<b>199.00</b>	<b>203.98</b>	<b>209.07</b>	<b>214.30</b>	<b>219.66</b>	<b>225.15</b>	<b>230.78</b>	<b>236.55</b>	<b>242.46</b>	<b>248.52</b>	<b>254.74</b>	<b>261.11</b>	<b>267.63</b>
<b>30GW BY 2030 WITH 30% RENEWABLE ENERGY</b>																	

Table from page 37

**Source:**

Federal Republic of Nigeria. (2016). *Sustainable Energy for All Action Agenda (SE4ALL-AA)*. Page 36-37.

[https://www.seforall.org/sites/default/files/NIGERIA\\_SE4ALL\\_ACTION\\_AGENDA\\_FINAL.pdf](https://www.seforall.org/sites/default/files/NIGERIA_SE4ALL_ACTION_AGENDA_FINAL.pdf)

**7.5 Nigeria's National Action Plan (NAP) to Reduce Short-Lived Climate Pollutants (SLCPs)**

This document mostly discusses how to reduce short-lived climate pollutants in Nigeria, but also mentions a target for electricity generation in table S1 shown below.

In Nigerias national action plan (NAP) from 2018, the country targeted 30% electricity generation from all renewable energy sources (RES incl.hydro) in 2030.

**Exact mention: “30% electricity generated using renewable energy in 2030”**

**Table S.1: SLCP abatement measures adopted in the National SLCP Plan**

Source Sector	SLCP Abatement Measures	Target
Transport	1. Renewal of urban bus fleet in Lagos 2. Adoption of CNG Buses in Nigeria 3. Introduction of low sulphur Diesel and Petrol 4. Elimination of high emitting vehicles that do not meet vehicle emission standards 5. Reduction of vehicle journeys by car through transport modal shifts	5000 new buses in Lagos complete and Danfo buses fully replaced by 2021 25% all Buses converted to CNG by 2030 50 ppm diesel fuel introduced in 2019; 150 ppm petrol introduced in 2021 Euro IV limits met by all vehicles by 2030  500, 000 daily journeys shifted from road to rail & waterways
Residential	6. Increase in population using modern fuels for cooking (LPG, electricity, kerosene, biogas, solar cookers) 7. Replacement of traditional biomass cookstoves with more efficient improved biomass stoves 8. Elimination of kerosene lamps	80% of H/H using modern fuels for cooking in 2030  20% H/H using improved biomass stoves for cooking in 2030  All kerosene lighting replaced by solar lamps by 2022
Oil & Gas	9. Elimination of gas flaring 10. Fugitive emissions/leakages Control 11. Methane Leakage Reduction	100% of gas flaring eliminated by 2020 50% Methane Reduction by 2030 50% Methane Reduction by 2030
Industry	12. Improved Energy Efficiency in industrial Sector	50% improvement in energy efficiency by 2050
Waste Management	13. Reduction of methane emissions and open burning of waste at open dumpsites through adoption of digesters at dump sites 14. Septic sludge collection 15. Sewerage Systems and Municipal wastewater treatment plants	50% methane recovered from landfills by 2030; 50% reduction in open burning of waste by 2030 Promote Septic sludge collection, treatment and recycling in 37 municipalities Establish, expand Sewerage Systems and municipal wastewater treatment plants in Lagos, Kanu and Port Harcourt
Agriculture	16. Increased adoption of intermittent aeration of rice paddy fields (AWD) 17. Reduce open-field burning of crop residues. 18. Anaerobic Digestion (AD) 19. Reduce methane emissions from enteric fermentation	50% cultivated land adopt AWD management system by 2030  50% reduction in the fraction of crop residue burned in fields by 2030 50% reduction by 2030 30% reduction in emission intensity by 2030
Power [Energy]	20. Expansion of National Electricity Coverage 21. Increase share of electricity generated in Nigeria from renewables	90% of the Population have access to electricity grid by 2030 30% electricity generated using renewable energy in 2030
HFCs	22. Elimination of HFC Consumption.	10% of HFCs phased out by 2030, 50% by 2040 and 80% by 2045

Table from page vi

*Note: The target was extracted from the 'Power [Energy]'-category in the table. The source was assumed to be RES including hydropower since a 30% target for 2030 is in line with what previously mentioned documents have targeted for RES (incl. hydro) for that same year, type and source.*

**Source:**

Federal Republic of Nigeria. (2018). *Nigeria's National Action Plan (NAP) to Reduce Short-Lived Climate Pollutants (SLCPs)*.

[https://climate-laws.org/documents/nigerias-national-action-plan-to-reduce-short-lived-climate-pollutants\\_c56a?id=nigerias-national-action-plan-to-reduce-short-lived-climate-pollutants\\_8eca](https://climate-laws.org/documents/nigerias-national-action-plan-to-reduce-short-lived-climate-pollutants_c56a?id=nigerias-national-action-plan-to-reduce-short-lived-climate-pollutants_8eca)

Accessed: 2025-04-18

**7.6 National Energy Masterplan**

*Note: Here targets for what was assumed to be installed capacity (based on the descriptions and exact mentions) from the National Energy Masterplan are listed.*

The National Energy Masterplan contains targets set in 2022 for the future. There were also four different growth rate scenarios used in this report for the projections of renewable electricity supply. Those different scenarios were 7%, 10%, 11.5% and 13% average GDP growth per annum, and the data for all of those were recorded. The target-values were extracted from tables 2.4-2.7, which are shown below.

In 2022 Nigeria targeted the following for installed capacity in solar power for 2025 as well as 2030, note the difference in the scenarios.

- 2025: 7 000 MW (7% GDP growth per annum)
- 2030: 25 917 MW (7% GDP growth per annum)
- 2025: 10 000 MW (10% GDP growth per annum)
- 2030: 37 225 MW (10% GDP growth per annum)
- 2025: 14 127 MW (11.5% GDP growth per annum)
- 2030: 42 578 MW (11.5% GDP growth per annum)
- 2025: 15 970 MW (13% GDP growth per annum)
- 2030: 48 132 MW (13% GDP growth per annum)

In 2022 Nigeria targeted the following for installed capacity in wind power for 2025 as well as 2030, note the difference in the scenarios.

- 2025: 25 MW (7% GDP growth per annum)
- 2030: 29 MW (7% GDP growth per annum)
- 2025: 36 MW (10% GDP growth per annum)
- 2030: 42 MW (10% GDP growth per annum)
- 2025: 42 MW (11.5% GDP growth per annum)
- 2030: 48 MW (11.5% GDP growth per annum)
- 2025: 47 MW (13% GDP growth per annum)
- 2030: 54 MW (13% GDP growth per annum)

**Exact mention:**

*“Renewable Supply Projections by Fuel Type (MW): Optimistic II Scenario 7% / Renewable Supply Projections by Fuel Type (MW): Optimistic II Scenario 10% / Renewable Supply Projections by Fuel Type (MW): Optimistic II Scenario 11.5% / Renewable Supply Projections by Fuel Type (MW): Optimistic II Scenario 13%” (page 11-12)*

**Table 2.4: Electricity Supply Projections by Fuel Type (MW): Optimistic II Scenario 7%**

	2009 (Based Yr)	2010	2015	2020	2025	2030
<b>Coal</b>	0	609	1850	6527	7545	10984
<b>Electricity Import</b>	0	0	0	0	0	31948
<b>Gas</b>	3803	4572	18679	33711	61891	80560
<b>Hydro (Large &amp; Small)</b>	1930	1930	3043	6533	6533	6533
<b>Nuclear</b>	0	0	1000	1500	2500	3500
<b>Small Hydro</b>	20	60	172	409	894	1886
<b>Solar</b>	0	260	1369	3455	7000	25917
<b>Wind</b>	0	10	19	22	25	29
<b>Biomass</b>	0	0	3	16	35	54
<b>Supply</b>	5753	7440	26092	52174	86422	161411

**Table 2.5: Electricity Supply Projections by Fuel Type (MW): Optimistic II Scenario 10%**

	2009 (Based Yr)	2010	2015	2020	2025	2030
Coal	0	870	2579	9324	10778	15691
Electricity Import	0	0	0	0	0	45640
Gas	3803	6957	21328	44763	82702	115086
Hydro (Large & Small)	1930	2174	4348	9332	9332	9332
Nuclear	0	0	1500	2500	3500	3500
Small Hydro	20	81	246	585	1277	2694
Solar	0	377	1956	4936	10000	370225
Wind	0	18	28	32	36	42
Biomass	0	0	4	23	50	77
Supply	5753	10476	31989	71495	117675	229086

**Table 2.6: Electricity Supply Projections by Fuel Type (MW): Optimistic II Scenario 11.5%**

	2009 (Based Yr)	2010	2015	2020	2025	2030
Coal	0	1000	2966	10723	12395	18045
Electricity Import	0	0	0	0	0	52486
Gas	3803	8000	23377	45728	106607	132348
Hydro (Large & Small)	1930	2500	5000	10732	10732	10732
Nuclear	0	0	2500	4500	5500	6369
Small Hydro	20	93	283	672	1469	3098
Solar	0	434	2250	5677	14127	42578
Wind	0	20	32	36	42	48
Biomass	0	0	4	27	58	88
Supply	5753	12047	36412	78095	150929	265794

**Table 2.7: Electricity Supply Projections by Fuel Type (MW): Optimistic II Scenario 13%**

	2009 (Based Yr)	2010	2015	2020	2025	2030
Coal	0	3353	3353	12122	14011	20399
Electricity Import	0	0	0	0	0	59333
Gas	3803	13110	26426	49996	120512	164307
Hydro (Large & Small)	1930	4157	11207	12132	12132	12132
Nuclear	0	0	3600	7200	7200	7200
Small Hydro	20	105	320	760	1660	3502
Solar	0	490	2543	6417	15970	48132
Wind	0	23	36	41	47	54
Biomass	0	0	5	30	65	100
Supply	5753	21238	47490	88698	171598	315158

Tables from page 11 and 12

*Note: "In table 2.5 (10% scenario) the solar-target states 370 225 MW, this was assumed to be 37 225 MW since both the solar target for 2030 from the 7% and 11.5% scenario were in the ten-thousands range and not the one hundred-thousands range."*

**Source:**

Energy Commission of Nigeria, Federal Ministry of Science, Technology Innovation, Federal Republic of Nigeria. (2022). *National Energy Masterplan*. Pages 8-12.

[https://energy.gov.ng/Energy\\_Policies\\_Plan/APPROVED\\_NEMP\\_2022.pdf](https://energy.gov.ng/Energy_Policies_Plan/APPROVED_NEMP_2022.pdf)

Accessed: 2025-04-18

## 7.7 Nigeria Agenda 2050

The Agenda 2050 is a plan for development until 2050, it also discusses renewable energy and sets some targets for renewable energy sources. This is shown in table below.

In the plan from 2023, Nigeria targets electricity generation shares from all renewable energy sources (RES incl. hydro). The first target in the plan aims for 2025 and the last for 2050 with several interim goals set in between. The targets set were the following:

- 20.83 % for 2025
- 28.67 % for 2030
- 36.50 % for 2035
- 44.33 % for 2040
- 52.17 % for 2045
- 60 % for 2050

### Exact mention:

**Table 10. 3 Objectives and Key Performance Indicators for Renewable Energy in Nigeria**

Objectives	Key Performance Indicators	Baseline	Target					
		2020	2025	2030	2035	2040	2045	2050
Energy generated and transmitted from renewable energy sources	Renewable energy share of electricity production (percent)	13	20.83	28.67	36.50	44.33	52.17	60
	Share of renewables in total electricity transmitted (percent)	22	27.50	33.0	38.5	44.0	49.5	55
	% of households using more efficient improved biomass stoves (percent)	5	7.5	10.0	12.5	15.0	17.5	20
	Proportion of abandoned wind energy project made operational (percent)	<1	17.5	34.0	50.5	67.0	83.5	100
Development of off-grid applications	Share of rural population served with off-grid (mini-grids and stand-alone) renewable energy electricity services (percent)	25	33.33	41.67	50.0	58.33	66.67	75
Accelerate adoption of clean cooking fuels and technologies	Share of population using improved cook stoves (percent)	13	24.17	35.33	46.5	57.67	68.83	80

Source: Federal Ministry of Power and Energy and International Energy Association; NBS 2018/2019 Nigerian Living Standards Survey (NLSS); Energy Information Administration; World Bank World Development Indicators; for baseline data; *Targets are benchmarked against Upper middle income African countries*

Table from page 99

*Note: The targets were extracted from the 'Energy generated and transmitted from renewable energy sources'-category and the 'Renewable energy share of electricity production (percent) '-subcategory in table 10.3.. The source was assumed to be RES including hydropower since a target of about 30% for 2030 is in line with what previously mentioned documents have targeted for RES (incl. hydro) for that same year, type and source.*

### Source:

Federal Republic of Nigeria. (2023). *Nigeria Agenda 2050*. Page 99.

<https://nationalplanning.gov.ng/wp-content/uploads/2023/05/Nigeria-Agenda-2050-Report-Corrected.pdf>

Accessed: 2025-04-19

## 8 Norway

### 8.1 Hvordan kan Norge nå sitt mål om fornybar energi i 2020?

As a response to the European Union's National renewable energy action plans (NREAP) from 2010, Norway in 2011 targeted a 67,5% share of renewable energy in gross final energy consumption from all renewable energy targets (RES incl.hydro) for 2020.

*Note: Since hydropower is one of the largest renewable energy sources in Norway it is assumed to be included in the target.*

**Exact mention:** “The government submitted a draft EEA directive on renewable energy to the EU in July 2011, which set a target of 67.5 percent renewable energy for Norway in 2020.” (page 46) (Translated from norwegian to english.)

#### Source:

Bøeng, A. C. (2011). *Hvordan kan Norge nå sitt mål om fornybar energi i 2020?*

[https://www.ssb.no/a/publikasjoner/pdf/oa\\_201106/boeng.pdf](https://www.ssb.no/a/publikasjoner/pdf/oa_201106/boeng.pdf)

### 8.2 Mer av alt – raskere. Energikommisjonens rapport

In 2023 Norway's Government targeted an increase in electricity generation from solar power to be achieved in 2030. The target was communicated as an interval of 5 to 10 TWh increase in solar power for 2030. In the same report Norway also targeted an increase in wind power communicated as an interval of 5 to 10 TWh for 2030 as well as 5 to 20 TWh specifically for offshore wind. Finally, Norway also targets an increase of 5 to 10 TWh hydro power in 2030.

*Note: In order to compare the target to actual amount, the already existing amount of solar-, wind-, and hydropower in 2023 was extracted from Statistiska sentralbyrån (Statistiska sentralbyrån, Fakta om vindkraft. (2025).*

<https://www.ssb.no/energi-og-industri/faktaside/vindkraft>) and (Statistiska sentralbyrån.

08308: *Produksjon av elektrisk kraft (GWh), etter region, statistikkvariabel og år. (2025).*

<https://www.ssb.no/statbank/table/08308/tableViewLayout1/> ). According to the source, the

existing amount in 2023 was 166 GWh, 13 965 GWh of wind power and 137 315 GWh

hydropower. The different intervals communicated for wind power were assumed to be

regarding onshore and offshore wind power separately, to get the total target for wind, these were summarized.

These values were then added to the targeted intervals, making the target for solar power 5166-10166 GWh in 2030, for wind power 23965-43965 GWh and for hydropower 142315-147315 GWh. In order to do the analysis, an average of these intervals was

calculated. The targets used in the project became 7666 GWh solar power in 2030, 33965 GWh wind power in 2030 and 144815 GWh for 2030.

**Exact mention:** *The Commission believes that it is realistic a development in the order of 5-10 TWh within 2030.* (page 17) (Translated from norwegian to english.)

*There is great uncertainty regarding how large an increase in wind power production is possible, but the Commission sees it as realistic to have wind power production in the order of 5-10 TWh higher in 2030 than what we have today.*

*However, given the areas that have been opened up, it should be a goal to have production in the order of 5-20 TWh from offshore wind by 2030.* (page 16) (Translated from norwegian to english.)

*The commission sees it as realistic with a production of hydropower which is 5-10 TWh higher in 2030 than what we have today.* (page 15) (Translated from norwegian to english.)

**Source:**

Andresen, Ø., Hauglie, A., Ringkjøb, H.E., Seim, H., Tomasgard, A., Fredriksen, B.F., Heia, G., Roland, K., Stubholt, L.M., Ulriksen, A., Gotaas, S., Lundberg, S.A., Rollesen, G., Tennbakk, B., Hamnaberg, H., Svaan, T.J., Jackson, M.S., Magnussen, I.H., Sørensen, J.A., Sundvall Rølling, N. (2023). *Mer av alt – raskere.*

<https://www.regjeringen.no/contentassets/5f15fcea3143d1bf9cade7da6afe6e/no/pdfs/nou202320230003000dddpdfs.pdf>

Accessed: 2025-04-19

## 9 Pakistan

### 9.1 Medium Term Development Framework

*Note: This source comes from a scan of the Pakistani Government's webpage by the Wayback Machine. The source itself is just a section of a larger report and at the writing of this appendix the original source page is unavailable. To find the source use the Wayback Machine, n.d, and use this url as the search word:*

<http://pc.gov.pk/mtdf/11-Environment/11-Environment.pdf>

#### 9.1.1 Installed capacity

In 2005 Pakistan targeted 880 MW in installed capacity from all renewable energy sources excluding hydropower (RES excl.hydro) for 2010.

*Note: The type was assumed to be installed capacity because of the unit MW. The source was assumed to be RES(excl. hydro) from the mention of (wind, solar, bio-gas etc.) when talking about renewable forms of energy. In the table the parentheses with the type is incomplete but it is assumed to be the same as other targets in the document. We also studied the plots with RES(incl. hydro) and found the targets had a much better fit with the actual values for RES(excl. hydro).*

**Exact mention:** “Energy production from renewable forms of energy”.

Keeping in view the MTDf recommendations & action plans, the following environmental targets have been fixed for next five years (2005-10).

**Table I**

S. No	Environmental Indicators	Year 2004-05	2009-10 Targets	2015 MDG Targets
1	Forest cover including State and private forests/farmlands (%age of total land area)	4.9%	5.2%	6.0%
2	Area protected for conservation of wildlife (as %age of total area)	11.3%	11.6%	12.0%
3	GDP (at constant factor cost) per unit of energy use as a proxy for energy efficiency	27,000 MW	27,600 MW	28,000 MW
4	Energy production from renewable forms of energy (wind, solar,	17 MW	880 MW	--
5	No. of petrol& diesel vehicles using CNG fuel	380,000	800,000	920,000

Table from page 4

#### 9.1.2 Electricity generation share

In the same report from 2005, Pakistan also targeted a 10% share of electricity generation from all renewable energy sources excluding hydro (RES excl.hydro).

**Exact mention:** “Promote renewable forms of energy (wind, solar, bio-gas etc.) that their share in total national power generation is at least 10% by 2015.”

*Note: The type was assumed to be electricity generation share from the unit and the mention of electricity generation. The source was assumed to be RES (excl. hydro) from the mention of (wind, solar, bio-gas etc.)*

**Source:** Internet Archive: Wayback Machine (Archived version of Planning Commission of Pakistan), nd, *MTDF(Medium Term Development Framework)-11. Environment and Sustainable Development*,

<https://web.archive.org/web/20130410011342/http://pc.gov.pk/mtdf/11-Environment/11-Environment.pdf#expand>

Accessed: 2025-04-01

#### 9.2 Policy for Development of Renewable Energy for Power Generation

In 2006 Pakistan targeted 9700 MW installed capacity of renewable energy sources excluding hydropower (RES excl.hydro) for 2030.

**Exact mention:** “Increase the deployment of renewable energy technologies (RETs) in Pakistan so that RE provides a higher targeted proportion of the national energy supply mix,

*i.e., a minimum of 9,700 MW by 2030 as per the Medium Term Development Framework (MTDF), and helps ensure universal access to electricity in all regions of the country.*“ (page 7)

*Note: The type was assumed to be installed capacity from the unit MW. The source was assumed to be RES(excl. hydro) from the passage: “For the purposes of this policy statement, ‘renewable energy’ (or RE) includes the following technologies: Small hydro of 50 MW or less capacity<sup>1</sup>, Solar photovoltaic (PV) and thermal energy for power generation, Wind power generation”. Here we assume that this excludes the majority of hydropower and such hydro can be excluded. To verify this we compared the target and the actual data for both RES excluding and including hydropower, and found that and the actual data for RES(excl. hydro) had the best match with the target.*

**Source:**

Government of Pakistan, (2006) , *Policy for Development of Renewable Energy for Power Generation: Employing Small Hydro, Wind, and Solar Technologies*,  
<https://www.ppib.gov.pk/policies/REpolicy2006.pdf>  
Accessed: 2025-04-01

### **9.3 POWER POLICY ALTERNATIVE and RENEWABLE ENERGY**

In 2019 Pakistan targeted total renewable electricity generation shares from all renewable sources except hydropower (RES excl.hydro) of 20% for 2025 and 30% for 2030.

**Exact mention:** *“It has been decided that rather than inducting RE projects on a reactive basis, a new policy direction is being set whereby Pakistan intends to have at least 20% of its generation capacity as ARE technologies by 2025 and 30% by 2030”*

*Note: The type is assumed to be electricity generation share. The following sources are included in this policy: biogas using any organic material, biomass (including but not limited to bagasse, agricultural waste, and other waste), energy from waste (including but not limited to municipal waste, industrial waste, sewage, refuse derived fuel), geothermal, hydrogen, synthetic gas (made from any source except fossil fuels), ocean/tidal wave energy, solar (PV or thermal, or any technology that uses heat and/or light of the sun to make electricity), storage technologies (including but not limited to battery systems, cells of all types, compressed gas), wind (on-shore and off-shore), and hybrids of any of the above technologies. The policy also extends to projects entailing retrofitting of existing bagasse, solar and wind projects to convert them into hybrid units. Some technologies not identified above are from time to time determined included for the purposes of this policy. Small hydro projects (less than 50 MW) are not covered under this policy. A separate policy is under consideration for small hydro.*

**Source:**

GOVERNMENT OF PAKISTAN MINISTRY OF ENERGY (POWER DIVISION), (2020), *POWER POLICY ALTERNATIVE and RENEWABLE ENERGY*,  
[https://www.ppib.gov.pk/policies/ARE\\_Policy\\_2019\\_-\\_Gazette\\_Notified.pdf](https://www.ppib.gov.pk/policies/ARE_Policy_2019_-_Gazette_Notified.pdf)

Accessed; 2025-04-01

#### **9.4 National Electricity Plan 2023-2027**

In 2023 Pakistan targeted a 40% renewable electricity generation share from all renewable energy sources (RES incl.hydro) in 2025 and 60% in 2030.

**Exact mention:** “*all the hydel generation shall be included in the definition of renewable energy and : accordingly, subject to the least cost criteria following on-grid (utility & distributed : scale) renewable energy targets have been envisaged: I) 40% of total generation capacity by FY-2025; II) 60% of total generation capacity by FY-2030;*”

**Source:** Ministry of Energy (Power Division), (2023), *National Electricity Plan 2023-2027-First Plan*

<https://power.gov.pk/SiteImage/Policy/National%20Electricity%20Plan%202023-27.pdf>

Accessed: 2025-04-01

## **10 Philippines**

### **10.1 PHILIPPINE ENERGY PLAN 2012-2030**

In 2010 the Philippines targeted 9525 MW installed capacity of renewable energy sources (RES incl.hydro) for 2030.

**Exact mention:** “*The NREP launched in June 2011 is the energy sector’s roadmap in the next 20 years to develop sustainable energy system and access to clean and green energy. It is aimed at increasing the renewable energy (RE) installed capacity to 9,525 MW (as aspirational target), which is more than double the 2010 level as base year.*”

**Source:** Republic of the Philippines- Department of Energy,(2012), *Philippine Energy Plan 2012 - 2030*,

[https://doe.gov.ph/sites/default/files/pdf/pep/2012-2030-pep-executive-summary\\_revised.pdf](https://doe.gov.ph/sites/default/files/pdf/pep/2012-2030-pep-executive-summary_revised.pdf)

Accessed: 2025-04-01

### **10.2 Renewable Energy Target of Philippines**

*Note: To access the source select the document named National Renewable Energy Program (NREP) 2011-2030 in the section called Link to Download.*

In 2010 the Philippines targeted renewable installed capacity from multiple energy sources for 2030. The implemented targets were the following:

- 3461 MW Geothermal

- 8723,1 MW Hydropower
- 315,7 MW Biomass
- 2,378 MW Wind power
- 285 MW Solar power

**Exact mention:**

**TABLE 3. RE-BASED CAPACITY INSTALLATION TARGETS, PHILIPPINES<sup>10</sup>**

Sector	Installed Capacity, (MW) as of 2010	Target Capacity Addition by				Total Capacity Addition (MW) 2011-2030	Total Installed Capacity by 2030
		2015	2020	2025	2030		
Geothermal	1,966.0	220.0	1,100.0	95.0	80.0	1,495.0	3,461.0
Hydro	3,400.0	341.3	3,161.0	1,891.8	0.0	5,394.1	8,724.1
Biomass	39.0	276.7	0.0	0.0	0.0	276.7	315.7
Wind	33.0	1,048.0	855.0	442.0	0.0	2,345.0	2,378.0
Solar	1.0	269.0	5.0	5.0	5.0	284.0	285.0
Ocean	0.0	0.0	35.5	35.0	0.0	70.5	70.5
<b>TOTAL</b>	<b>5,438.0</b>	<b>2,155.0</b>	<b>5,156.5</b>	<b>2,468.8</b>	<b>85.0</b>	<b>9,865.3</b>	<b>15,304.3</b>

Table from page 23

**Source:** Republic of the Philippines- Department of Energy, (2011), *National Renewable Energy Program (NREP) 2011-2030*,

<https://aseanenergy.org/policy/renewable-energy-target-of-philippines/>

Accessed: 2025-04-01

### 10.3 National Renewable Energy Program

*Note: To access the information from source select the tab called “Executive Summary” from the preselected one called “NREP Home”.*

In the NREP from 2011 the Philippines targeted 15304 MW installed capacity of renewable energy sources (RES incl.hydro) for 2030.

**Exact mention:** “The NREP seeks to increase the RE-based capacity of the country to an estimated 15,304 MW by the year 2030, almost triple its 2010 level.”

**Source:**

Republic of the Philippines- Department of Energy, nd, *National Renewable Energy Program*, <https://doe.gov.ph/national-renewable-energy-program> (Accessed 2025-04-01).

Accessed: 2025-04-01

### 10.4 Philippine Energy Plan 2023-2050

In 2020 the Philippines targeted a 35% renewable electricity generation share from all renewable energy sources (RES incl.hydro) by 2030 as well as a 50% share for 2040.

**Exact mention:** *“The DOE foresees achieving a 35 percent share by 2030, 50 percent by 2040, and more than 50 percent by 2050 in the power generation mix.”*

**Source:** Republic of the Philippines- Department of Energy, (2023), *PHILIPPINE ENERGY PLAN 2023 - 2050 VOLUME II*,

<https://doe.gov.ph/sites/default/files/pdf/pep/PEP%202023-2050%20Vol.%20II.pdf>

Accessed: 2025-04-01

## **11 Poland**

### **11.1 "Announcement of the Minister of Economy and Labour"**

*Note: This document was written in polish and therefore everything was translated through Google Translate (“” signifies text directly translated from the document).*

In this document Poland targeted the gross final electricity consumption of renewable energy sources from 2005 for the years leading up to and including 2014. The targets regard all renewable energy sources (RES incl.hydro). The targets were the following:

- 2005: 2,2 %
- 2006: 2,6 %
- 2007: 3,2 %
- 2008: 4,0 %
- 2009: 5,3 %
- 2010: 7,5 %
- 2011: 7,5 %
- 2012: 7,5 %
- 2013: 7,5 %
- 2014: 7,5 %

**Exact mention:** *"Percentage share of electricity from renewable sources in the electricity consumption balance in the EU-25 in the base year and in 2010 resulting from the provisions of the directive"*

Rok	Energia elektryczna z OZE	
	Aktualny plan (zgodny w 2010 r. z dyrektywą Nr 2001/77/WE)	
	TWh	%
2005	3,12	2,2
2006	3,72	2,6
2007	4,61	3,2
2008	5,80	4,0
2009	7,74	5,3
2010	11,10	7,5
2011	11,18	7,5
2012	11,33	7,5
2013	11,48	7,5
2014	11,63	7,5

Table from page 1726

**Source:**

M.P. 2005 nr 53 poz. 731. *Obwieszczenie ministra gospodarki i pracy z dnia 31 sierpnia 2005 r. w sprawie ogłoszenia raportu określającego cele w zakresie udziału elektrycznej wytworzonej w odnawialnych źródłach energii znajdujących się na terytorium Rzeczypospolitej Polskiej, w krajowym zużyciu energii elektrycznej w latach 2005-2014.* Page 1726. <https://isap.sejm.gov.pl/isap.nsf/download.xsp/WMP20050530731/O/M20050731.pdf>  
 Accessed: 2025-04-01

**11.2 EU Directive 2009/28/EU**

*Note: In this directive targets were established for EU countries regarding what their share of renewable energy sources would be in their gross final energy consumption in 2020.*

In accordance with EU Directive 2009/28/EU Poland targeted a 15% renewable gross energy from all renewable energy sources (RES incl. hydro) consumption for 2020.

**Exact mention:**

A. National overall targets

	Share of energy from renewable sources in gross final consumption of energy, 2005 (S <sub>2005</sub> )	Target for share of energy from renewable sources in gross final consumption of energy, 2020 (S <sub>2020</sub> )
Belgium	2,2 %	13 %
Bulgaria	9,4 %	16 %
Czech Republic	6,1 %	13 %
Denmark	17,0 %	30 %
Germany	5,8 %	18 %
Estonia	18,0 %	25 %
Ireland	3,1 %	16 %
Greece	6,9 %	18 %
Spain	8,7 %	20 %
France	10,3 %	23 %
Italy	5,2 %	17 %
Cyprus	2,9 %	13 %
Latvia	32,6 %	40 %
Lithuania	15,0 %	23 %
Luxembourg	0,9 %	11 %
Hungary	4,3 %	13 %
Malta	0,0 %	10 %
Netherlands	2,4 %	14 %
Austria	23,3 %	34 %
Poland	7,2 %	15 %
Portugal	20,5 %	31 %
Romania	17,8 %	24 %
Slovenia	16,0 %	25 %
Slovak Republic	6,7 %	14 %
Finland	28,5 %	38 %
Sweden	39,8 %	49 %
United Kingdom	1,3 %	15 %

Table from page 31

**Source:**

Directive 2009/28/EC of the European Parliament and of the council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC. *Official Journal of the European Union*, L 140, 46.

<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0028&qid=1743077656138>

Accessed: 2025-04-01

**11.3 NREAP**

*Note: In this document Poland sets targets regarding renewable energy sources, with a target year of 2020. There are also what appears to be targeted values for 2005, 2010 and 2015. However both 2005 and 2010 were disregarded since our starting year for this source is 2011. The values for 2015 were not used because they seemed to be calculated values in between the starting year and the target year, and not an actual target.*

11.3.1 Electricity generation

In the NREAP from 2011, Poland targeted renewable electricity generation for 2020. The targets were the following:

- 3 GWh solar power

- 15 210 GWh wind power
- 13 160 GWh onshore wind power
- 1050 GWh offshore wind power
- 32 400 GWh electricity generation from all renewable energy sources (RES incl.hydro)

### Exact mention:

	2005						2010						2015						2020					
	[GWh]	[ktoe]	[%] <sup>a</sup>	[%] <sup>b</sup>	[%] <sup>c</sup>	[%] <sup>d</sup>	[GWh]	[ktoe]	[%] <sup>a</sup>	[%] <sup>b</sup>	[%] <sup>c</sup>	[%] <sup>d</sup>	[GWh]	[ktoe]	[%] <sup>a</sup>	[%] <sup>b</sup>	[%] <sup>c</sup>	[%] <sup>d</sup>	[GWh]	[ktoe]	[%] <sup>a</sup>	[%] <sup>b</sup>	[%] <sup>c</sup>	[%] <sup>d</sup>
Hydropower < 1MW	358	31	9.5	0.0	0.0	0.0	357	31	3.4	0.5	0.3	0.1	427	37	2.1	0.5	0.3	0.1	497	43	1.5	0.4	0.3	0.1
Hydropower 1MW - 10 MW	504	43	13.3	0.0	0.0	0.0	534	46	5.0	0.8	0.4	0.1	624	54	3.1	0.7	0.4	0.1	714	61	2.2	0.6	0.4	0.1
Hydropower >10MW	1339	115	35.4	0.0	0.0	0.0	1388	119	13.1	2.0	1.0	0.2	1388	119	7.0	1.6	0.9	0.2	1738	151	5.4	1.4	1.0	0.2
Hydropower (subtotal)	2201	189	58.1	0.0	0.0	0.0	2279	196	21.5	3.3	1.6	0.3	2439	210	12.3	2.8	1.6	0.3	2969	255	9.2	2.4	1.7	0.4
Geothermal	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0
Solar photovoltaic	0	0	0.0	0.0	0.0	0.0	1	0	0.0	0.0	0.0	0.0	2	0	0.0	0.0	0.0	0.0	3	0	0.0	0.0	0.0	0.0
Concentrated solar power	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0
Solar (subtotal)	0	0	0.0	0.0	0.0	0.0	1	0	0.0	0.0	0.0	0.0	2	0	0.0	0.0	0.0	0.0	3	0	0.0	0.0	0.0	0.0
Tidal, wave and ocean energy	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0
Onshore wind	136	12	3.6	0.0	0.0	0.0	2310	199	21.8	3.4	1.6	0.3	7370	634	37.1	8.3	4.8	1.0	13160	1132	40.6	10.6	7.8	1.6
Offshore wind	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	1050	90	3.2	0.8	0.6	0.1
Wind power (subtotal)	136	12	3.6	0.0	0.0	0.0	2310	199	21.8	3.4	1.6	0.3	7541	648	37.9	8.5	4.9	1.0	15210	1308	46.9	12.2	9.0	1.9
Solid biomass	1340	115	35.4	0.0	0.0	0.0	5700	490	53.7	8.3	4.1	0.8	8950	770	45.0	10.1	5.9	1.2	10200	877	31.5	8.2	6.0	1.3
Biogas	111	10	2.9	0.0	0.0	0.0	328	28	3.1	0.5	0.2	0.0	943	81	4.7	1.1	0.6	0.1	4018	345	12.4	3.2	2.4	0.5
Bioliquids	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0
Biomass (subtotal)	1451	125	38.3	0.0	0.0	0.0	6028	518	56.8	8.8	4.3	0.8	9893	851	49.8	11.2	6.5	1.3	14218	1223	43.9	11.4	8.4	1.8
Total (according to Template Tables 10a/b)	3787	326	100.0	0.0	0.0	0.0	10618	913	100.0	15.5	7.5	1.5	19875	1709	100.0	22.4	13.0	2.7	32400	2786	100.0	26.0	19.1	4.0
Sum of all technologies (Template Tables 10a/b)	3788	326	100.0	0.0	0.0	0.0	10618	913	100.0	15.5	7.5	1.5	19875	1709	100.0	22.4	13.0	2.7	32400	2786	100.0	26.0	19.1	4.0
Gross final RES-E consumption (Template Table 4a)		n.a.	0.0	0.0	0.0	0.0		913	100.0	15.5	7.5	1.5		1709	100.0	22.4	13.0	2.7		2786	100.0	26.0	19.1	4.0

Table from page 223

*Note: The target for solar power refers to the sum of both Solar PV and concentrated solar power; however, note that Poland targets only solar PV and not concentrated solar power. For the RES-target, the stated amount was assumed to refer to electricity generation and the target was extracted from the table (from page 223) shown above. The target was taken from the 'Total (according to Template Tables 10a/b)' row in GWh. Because it is the total amount the source was assumed to be RES (including hydropower).*

### 11.3.2 Installed capacity

In the NREAP, Poland also targets renewable installed capacity for 2020. The targets were the following:

- 3 MW solar power
- 6650 MW wind power
- 5600 MW onshore wind power
- 500 MW offshore wind power

### Exact mention:

Table 75: Projected total solar electric capacity [MW] for the period 2005 - 2020, including photovoltaic (PV) and concentrated solar power (CSP)

	2005 [MW]	2010 [MW]	2015 [MW]	2020 [MW]	2020 [%]
Belgium	2	350	713	1340	1
Bulgaria	0	9	220	303	0
Czech Republic	1	1650	1680	1695	2
Denmark	3	3	4	6	0
Germany	1980	15784	34279	51753	57
Estonia	n.a.	n.a.	n.a.	n.a.	n.a.
Ireland	0	0	0	0	0
Greece	1	184	1300	2450	3
Spain	60	4653	8966	13445	15
France	25	504	2353	5400	6
Italy	34	2505	5562	8600	9
Cyprus	0	6	87	267	0
Latvia	0	0	1	2	0
Lithuania	0	1	10	10	0
Luxembourg	24	27	88	113	0
Hungary	n.a.	0	19	63	0
Malta	0	4	27	28	0
Netherlands	51	92	317	722	1
Austria	22	90	179	322	0
Poland	0	1	2	3	0
Portugal	3	156	720	1500	2
Romania	0	0	148	260	0
Slovenia	0	12	37	139	0
Slovakia	0	60	160	300	0
Finland	0	0	0	10	0
Sweden	4	5	7	8	0
United Kingdom	11	50	1070	2680	3
All Member States (total)	2221	26146	57949	91419	100

More information on subcategories for solar electricity capacity is presented in Table 77 on page 90.  
See Table 78 on page 91 for corresponding solar electricity production data.

## Table from page 88

Table 91: Projected total wind power electric capacity [MW] for the period 2005 - 2020, including both onshore and offshore wind power

	2005 [MW]	2010 [MW]	2015 [MW]	2020 [MW]	2020 [%]
Belgium	190	733	2049	4320	2
Bulgaria	8	336	984	1256	1
Czech Republic	22	243	493	743	0
Denmark	3129	3584	4180	3960	2
Germany	18415	27676	36647	45750	21
Estonia	31	147	400	650	0
Ireland	494	2088	3151	4649	2
Greece	491	1327	4303	7500	4
Spain	9918	20155	27997	38000	18
France	752	5542	13445	25000	12
Italy	1639	5800	9068	12680	6
Cyprus	0	82	180	300	0
Latvia	26	28	104	416	0
Lithuania	1	179	389	500	0
Luxembourg	35	35	105	131	0
Hungary	n.a.	330	577	750	0
Malta	0	0	7	110	0
Netherlands	1224	2221	5578	11178	5
Austria	694	1011	1951	2578	1
Poland	121	1100	3540	6650	3
Portugal	1063	4256	6125	6875	3
Romania	1	560	3200	4000	2
Slovenia	0	2	60	106	0
Slovakia	5	5	300	350	0
Finland	80	170	670	2500	1
Sweden	536	1873	3210	4547	2
United Kingdom	1565	5430	14210	27880	13
All Member States (total)	40440	84913	142922	213379	100

See Table 94 on page 109 for corresponding wind power electricity production data.

## Table from page 106

Table 93: Projected wind power electric capacity [MW] for the period 2005 - 2020, broken down into onshore

	Onshore wind				Offshore wind			
	2005 [MW]	2010 [MW]	2015 [MW]	2020 [MW]	2005 [MW]	2010 [MW]	2015 [MW]	2020 [MW]
Belgium	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Bulgaria	8	336	984	1256	0	0	0	0
Czech Republic	22	243	493	743	n.a.	n.a.	n.a.	n.a.
Denmark	2706	2923	2929	2621	423	661	1251	1339
Germany	18415	27526	33647	35750	0	150	3000	10000
Estonia	31	147	400	400	n.a.	n.a.	n.a.	250
Ireland	469	2052	2899	4094	25	36	252	555
Greece	491	1327	4303	7200	n.a.	n.a.	n.a.	300
Spain	9918	20155	27847	35000	0	0	150	3000
France	752	5542	10778	19000	0	0	2667	6000
Italy	1639	5800	8900	12000	0	0	168	680
Cyprus	0	82	180	300	n.a.	n.a.	n.a.	n.a.
Latvia	26	28	104	236	n.a.	n.a.	n.a.	180
Lithuania	1	179	389	500	0	0	0	0
Luxembourg	35	35	105	131	0	0	0	0
Hungary	n.a.	330	577	750	n.a.	0	0	0
Malta	n.a.	0	7	15	n.a.	0	0	95
Netherlands	1224	1993	4400	6000	0	228	1178	5178
Austria	694	1011	1951	2578	0	0	0	0
Poland	121	1100	3350	5600	0	0	0	500
Portugal	1063	4256	6100	6800	0	0	25	75
Romania	1	560	3200	4000	0	0	0	0
Slovenia	0	2	60	106	0	0	0	0
Slovakia	5	5	300	350	0	0	0	0
Finland	80	n.a.	n.a.	n.a.	0	n.a.	n.a.	n.a.
Sweden	513	1797	3081	4365	23	76	129	182
United Kingdom	1351	4040	8710	14890	214	1390	5500	12990
All Member States (total)	39565	81469	125694	164685	685	2541	14320	41324

Table from page 108

### 11.3.3 Gross final electricity consumption

Finally, in the NREAP, Poland also targeted 19,1% renewable gross final electricity consumption from all renewable energy sources (RES incl.hydro) for 2020.

*Note: The target was extracted from the ‘Gross final RES-E consumption (Template Table 4a)’ row and [%]^c column (c is given the following explanation in the document: ‘The percentages refer to the values in the column ‘[ktoe]’ and express the share of the renewable technology in the sector total of the final gross energy consumption (‘Additional energy efficiency scenario’ only), see values highlighted in bold). Based on the exact mention the source was assumed to be RES-E (including hydropower).*

#### Exact mention:

	Renewable production	Electricity		2020					Page	
				[GWh]	[ktoe]	[%]^a	[%]^b	[%]^c		[%]^d
			Hydropower < 1MW	497	43	1.5	0.4	0.3	0.1	75
			Hydropower 1MW - 10 MW	714	61	2.2	0.6	0.4	0.1	75
			Hydropower >10MW	1758	151	5.4	1.4	1.0	0.2	75
			Hydropower (subtotal)	2969	255	9.2	2.4	1.7	0.4	75
			Geothermal	0	0	0.0	0.0	0.0	0.0	82
			Solar photovoltaic	3	0	0.0	0.0	0.0	0.0	93
			Concentrated solar power	0	0	0.0	0.0	0.0	0.0	93
			Solar (subtotal)	3	0	0.0	0.0	0.0	0.0	93
			Tidal, wave and ocean energy	0	0	0.0	0.0	0.0	0.0	100
			Onshore wind	13160	1132	40.6	10.6	7.8	1.6	111
			Offshore wind	1050	90	3.2	0.8	0.6	0.1	111
			Wind power (subtotal)	15210	1308	46.9	12.2	9.0	1.9	111
			Solid biomass	10200	877	31.5	8.2	6.0	1.3	121
			Biogas	4018	345	12.4	3.2	2.4	0.5	121
			Bioliquids	0	0	0.0	0.0	0.0	0.0	121
			Biomass (subtotal)	14218	1223	43.9	11.4	8.4	1.8	121
			Total (according to Template Tables 10a/b)	32400	2786	100.0	26.0	19.1	4.0	-
			Sum of all technologies (Template Tables 10a/b)	32400	2786	100.0	26.0	19.1	4.0	-
			Gross final RES-E consumption (Template Table 4a)		2786	100.0	26.0	19.1	4.0	64 – 67

Table from page 223

#### Source:

Beurskens, L.W.M., & Hekkenberg, M. (2011). *Renewable Energy Projections as Published in the National Renewable Energy Action Plans of the European Member States.*

[https://www.eea.europa.eu/en/analysis/maps-and-charts/national-renewable-energy-action-plans/nreap\\_draft\\_report\\_eea-ecm\\_20100830.pdf/@@download/file](https://www.eea.europa.eu/en/analysis/maps-and-charts/national-renewable-energy-action-plans/nreap_draft_report_eea-ecm_20100830.pdf/@@download/file)

Accessed: 2025-04-01

## 11.4 NECP- National Energy and Climate Plan

In the NECP from 2019 Poland targets both gross final electricity and energy consumption from renewable sources. The data was collected from table 28 shown below.

### 11.4.1 Gross final energy consumption

In the NECP Poland targeted 23% gross final energy consumption from all renewable energy sources (RES incl.hydro) for 2030 as well as 28,5% for 2040.

### 11.4.2 Gross final electricity consumption

In the NECP Poland also targeted 31,8% gross final energy consumption from all renewable energy sources (RES incl.hydro) for 2030 as well as 39,7% for 2040.

### Exact mention:

Table 28. Projected total and sectoral gross final renewable energy consumption [ktoe] and the share of RES consumption – total and by sector [%] – ECP scenario

[ktoe]	2005	2010	2015	2020	2025	2030	2035	2040
<b>gross final energy consumption (RES-OS denominator)</b>	<b>61573.8</b>	<b>69156.4</b>	<b>64596.0</b>	<b>73512</b>	<b>71508</b>	<b>69345</b>	<b>68906</b>	<b>68836</b>
gross final renewable energy consumption	4245.4	6399.3	7664.4	11 027	13 143	15 937	17 761	19 637
consumption of RES in electricity	331.7	890.3	1894.3	3369	4004	5493	6581	7715
consumption of RES in district heating and cooling	3867.6	4641.6	5116.7	6163	7604	9027	9812	10601
consumption of RES in transport	95.2	916.2	721.2	1613	1677	1708	1856	2024
[%]	2005	2010	2015	2020	2025	2030	2035	2040
<b>share of RES in gross final energy consumption</b>	<b>6.9%</b>	<b>9.3%</b>	<b>11.9%</b>	<b>15.0%</b>	<b>18.4%</b>	<b>23.0%</b>	<b>25.8%</b>	<b>28.5%</b>
share of RES in the electricity sector	3.1%	7.0%	13.4%	22.1%	24.8%	31.8%	36.0%	39.7%
share of RES in district heating and cooling	10.2%	11.7%	14.5%	17.4%	22.7%	28.4%	31.5%	34.4%
share of renewable energy in transport (with multipliers)	1.6%	6.6%	6.4%	10.0%	11.2%	14.0%	17.7%	22.0%

Table from page 33

### Source:

Republic of Poland. (2019). *Energy and climate policy (ECP) scenario: Impact assessment of policies and measures: Annex 2 to the National Energy and Climate Plan for 2021-2030.*

Page 33.

[https://energy.ec.europa.eu/system/files/2020-08/pl\\_final\\_necp\\_part\\_5\\_en\\_0.pdf](https://energy.ec.europa.eu/system/files/2020-08/pl_final_necp_part_5_en_0.pdf)

Accessed: 2025-04-01

## 11.5 NECP, updated draft

This document is Poland's updated version of their NECP. In this updated draft a new target is set for gross final energy consumption of renewable energy sources in 2030.

In the updated NECP from 2023 Poland targeted 29,8% gross final energy consumption from renewable sources (RES incl.hydro) for 2030.

**Exact mention:** “Poland declares to achieve 29.8 % share of RES in gross final energy consumption by 2030”

**Source:**

Republic of Poland. (2023). *National Plan in the field of Energy and Climate by 2030*. Page 16.

[https://commission.europa.eu/document/download/5118b15e-d380-49ae-b8bb-41cc81a28e15\\_en?filename=PL\\_NECUpdate\\_Projekt\\_EN.pdf](https://commission.europa.eu/document/download/5118b15e-d380-49ae-b8bb-41cc81a28e15_en?filename=PL_NECUpdate_Projekt_EN.pdf)

Accessed: 2025-04-01

## 12 Saudi Arabia

### 12.1 K.A.CARE (2012)

*Note: This source is not a direct policy document, but a scientific article describing previously set targets of renewable energy in Saudi Arabia, therefore note that the base year is not the same for all targets.*

In 2012 Saudi Arabia targeted 24 GW electricity generation from solar power for 2020.

**Exact mention:** “The capability of solar power was lower than 10 GW and estimated to be augmented to 24 GW by 2020”

Saudi Arabia also targeted renewable installed capacity for 2032. The targets were the following:

- 57 GW solar power for 2032
- 2 GW wind power for 2032.
- 54 GW renewable installed capacity from all renewable energy sources excluding hydropower (RES excl.hydro).

*Note: RES is assumed to be excluding hydropower due the information in the source and the geographical prospects for potential hydropower in Saudi Arabia.*

**Exact mention:**

“Furthermore, the Saudi authority has set a huge investment (a capital of \$384 billion) to diversify the resources of energy, aiming to meet the demands of power to all sectors at the whole regions all over the country, with a capacity of more than 123 GW by 2032, with about 52 GW, 46 GW, 5 GW, 2 GW, to be produced by PV, nuclear energy, CSP, and wind, respectively. In addition to the other clean resources of RnSE such as combined cycle gas turbine (CCGT), gas turbine cogen (GTC), steam, steam cogen and open cycle GT, to be installed in the period between 2015 and 2032” (page 5)

“By the end of 2012, the KACARE project announced its aim to develop approximately 16 GW of PV energy and 25 GW of thermal energy, with a total RnSE of 24 GW by 2020 and 54 GW by 2032...” (page 10)

Finally, in 2012 Saudi Arabia also targeted renewable installed capacity for 2040. The targets were the following:

- 41 GW solar power for 2040.
- 9 GW wind power for 2040.
- 3 GW waste energy for 2040.
- 1 GW geothermal energy for 2040.

**Exact mention:**

“SEC planned to decrease the burning of crude for electricity supply by switching to natural gas, thereby targeting to build up RnSE sources for electric energy supply. KACARE had also raised calls for extra wind, nuclear, and solar powers with capacities of 9, 17.6, and 41 GW, respectively, by 2040...”

**Table 3**

RnSE resources in the KSA, in 2017 (Alyahya and Irfan, 2016; Kingdom of Saudi Arabia and Saudi Vision, 2030, 2016).

Technology	Capacity (GW) by 2040	Capacity (%) by 2040
These aims started in 2017 by 1/10 of RnSE facilities with a great demand on natural gas in total primary power mix		
Nuclear	17.6	12.2
PV	16	11.2
CSP	25	17.5
Wind	9	6.3
Geothermal	1	0.7
Waste-to-energy	3	2.1

Table from page 8

**Source:**

Y. H. Ahssein Amran, Y.H. Mugahed Amran, R. Alyousef, H. Alabduljabbar, 2019. *Renewable and sustainable energy production in Saudi Arabia according to Saudi Vision 2030; Current status and future prospects.*

<https://www.sciencedirect.com/science/article/pii/S0959652619344725?via%3Dihub>

Accessed: 2025-04-17

**12.2 Vision 2030 and the birth of Saudi solar energy, MEI policy focus 2016 -15**

*Note: This source is not a direct policy document, but a scientific article describing previously set targets of renewable energy in Saudi Arabia, therefore note that the base year is not the same for all targets.*

**12.2.1 Electricity generation share**

In 2016 Saudi Arabia targeted 4% renewable electricity generation share for 2020 and 10% for 2023.

### 12.2.2 Installed capacity

In 2016 Saudi Arabia also targeted 3,45 GW installed capacity of renewable energy sources (RES (excl.hydro)) for 2020 and 9,5 GW (RES (excl.hydro)) for 2023.

#### Exact mention:

*“The projects will be pursued under the “King Salman Renewable Energy Initiative,” details of which are expected to be announced soon.<sup>7</sup> The National Transformation Program 2020, which was announced in early June following the Vision 2030, set the target of 3.45GW, or 4 percent of the total power consumption, by 2020.”, “Furthermore, the National Renewable Energy Program with the SV2030 and the National Transformation Program (Alnatheer, 2006, Kingdom of Saudi Arabia, 2016) launched its targets to upsurge the RnSE shares sustainably to up to 3.45 and 9.5 GW by 2020 and 2023, with almost 4% and 10% of the KSA’s total energy generation, respectively”*

*Note: The targets are assumed to be excluding hydropower. (RES (excl.hydro)).*

#### Source:

Yamada, M. (2016). *Vision 2030 and the birth of Saudi solar energy*. Middle East Institute.

<https://www.jstor.org/stable/pdf/resrep17610.pdf>

Accessed: 2025-04-17

### 12.3 Saudi Arabia - National Renewable Energy Program, Vision 2030

In 2018 Saudi Arabia targeted 7 GW installed capacity of wind power and 20 GW solar power for 2023.

#### Exact mention:

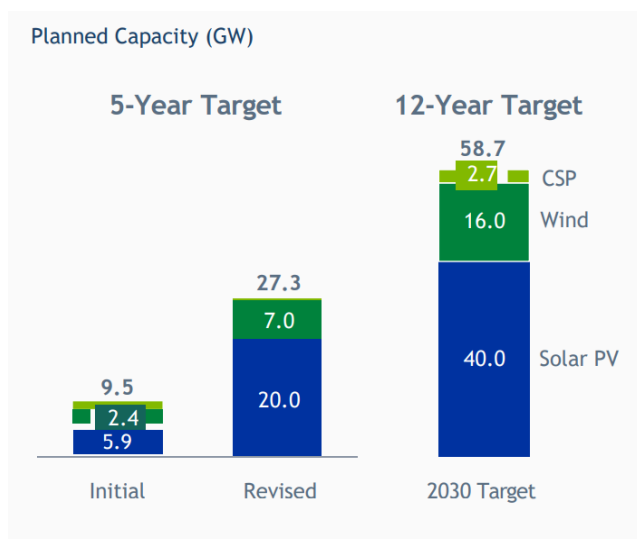


Table from page 2

**Source:** International Energy Forum. (2019, February 26). *Third IEF-EU Energy Day: Presentation by Turki Al-Shehri.*

[https://www.ief.org/\\_resources/files/events/third-ief-eu-energy-day/turki-al-shehri-24.02-repd-o---ief-riyadh\\_v2-2.pdf](https://www.ief.org/_resources/files/events/third-ief-eu-energy-day/turki-al-shehri-24.02-repd-o---ief-riyadh_v2-2.pdf)

#### **12.4 Vision 2030**

*Note: This source is not a direct policy document, but a scientific article describing previously set targets of renewable energy in Saudi Arabia, therefore note that the base year is not the same for all targets.*

In 2018 Saudi Arabia targeted 200 GW installed capacity of solar power for 2030 in plan with the SoftBank Vision Fund.

#### **Exact mention:**

*”200 GW solar energy plan with SoftBank Vision Fund, which aims to establish the largest solar energy production capacity in the world”*

*”Saudi Arabia's Vision 2030 focuses on diversifying energy sources (9.5 GW of RE by 2030), also, 200 GW (one of the largest solar energy capacity) collaborating with SoftBank Vision Fund.”*

In 2019 Saudi Arabia established the following targets for renewable installed capacity:

- 27,3 GW installed capacity of all renewable energy sources (RES (excl.hydro)) for 2024.
- 58,7 GW installed capacity of all renewable energy sources (RES (excl.hydro)) for 2030.
- 40 GW solar power for 2030.
- 16 GW wind power for 2030.

*Note: The RES targets are assumed to not include hydropower*

#### **Exact mention:**

”According to Patalong, Saudi Arabia has set ambitious goals for renewable energy, hoping to reach 27.3 GW by 2024 and 58.7 GW by 2030. The energy minister stated in 2023 that the goal is to produce 130 GW of RE annually by 2030. ”

“Saudi Arabia targets 58.7 GW of renewable energy by 2030, including 40 GW from solar PV, as outlined in its NREP.”

“By 2030, Saudi Arabia wants to produce 58.7 GW of renewable energy, of which 40 GW will come from solar photovoltaics (solar PV), 16 GW from wind energy, and 2.7 GW from concentrated solar power (CSP) shows electricity and RE infrastructure and resource map of Saudi Arabia.”

**Source:**

Islam, M. T., & Ali, A. (2024). *Sustainable green energy transition in Saudi Arabia: Characterizing policy framework, interrelations and future research directions* . King Fahd University of Petroleum and Minerals.

<https://www.sciencedirect.com/science/article/pii/S2949821X24000668?via%3Dihub>

Accessed: 2025-04-17

## 13 Spain

### 13.1 EU Directive 2001/27/EC

The EU directive 2001/27/EC targets 29,4% renewable Gross final electricity consumption (RES-E including hydro) for Spain for 2010. This is a binding target.

**Exact mention:**

	RES-E TWh 1997 (**)	RES-E % 1997 (***)	RES-E % 2010 (***)
Belgium	0,86	1,1	6,0
Denmark	3,21	8,7	29,0
Germany	24,91	4,5	12,5
Greece	3,94	8,6	20,1
Spain	37,15	19,9	29,4

**Source:** European Parliament & Council of the European Union. (2001). *Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market*. Official Journal of the European Communities, L 283/33.

<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32001L0077>

Accessed: 2025-04-01

## **13.2 Plan de energías renovables en España 2005, 2010**

*Note: The plan is written in spanish, parts of the text have been translated to english using Google Translate in order to gain a better understanding of the information presented.*

### 13.2.1 Electricity generation

This is a national plan including targets set by the Spanish government for 2010. In the national plan from 2005, Spain targeted the following for renewable electricity generation by 2010:

- 38186 GWh hydropower (subtotal).
- 15433 GWh biomass (biomass + biogas).
- 45511 GWh wind power.
- 1907 GWh solar power (subtotal, solar fotovoltaica + solar termoelectrica).
- In total Spain targets 102259 GWh renewable electricity generation (RES incl. hydro).

### 13.2.2 Gross final electricity consumption

The total RES-E (including hydro) target translates to 30,3% gross final electricity consumption.

### 13.2.3 Gross final energy consumption

In the plan, Spain further targets 12,1% renewable gross final energy consumption.

**Exact mention:**

**OBJETIVOS DEL PLAN DE ENERGÍAS RENOVABLES EN ESPAÑA 2005-2010**  
**Escenario PER**

	Situación en 2004 [año medio (1)]			Objetivo de incremento 2005-2010 (2)			Situación Objetivo en el año 2010		
	Potencia (MW)	Producción (GWh)	Producción en términos de Energía Primaria (ktep)	Potencia (MW)	Producción (GWh)	Producción en términos de Energía Primaria (ktep)	Potencia (MW)	Producción (GWh)	Producción en términos de Energía Primaria (ktep)
<b>Generación de electricidad</b>									
Hidráulica (> 50 MW) (3)	13.521	25.014	1.979	0	0	0	13.521	25.014	1.979
Hidráulica (Entre 10 y 50 MW)	2.897	5.794	498	360	687	59	3.257	6.480	557
Hidráulica (< 10 MW)	1.749	5.421	466	450	1.271	109	2.199	6.692	575
Biomasa	344	2.193	680	1.695	11.823	4.458	2.039	14.015	5.138
Centrales de biomasa	344	2.193	680	973	6.787	2.965	1.317	8.960	3.586
Co-combustión	0	0	0	722	5.036	1.532	722	5.036	1.552
R.S.U.	189	1.223	395	0	0	0	189	1.223	395
Eólica	8.155	19.571	1.683	12.000	25.940	2.231	20.155	45.511	3.914
Solar fotovoltaica	37	56	5	363	553	48	400	609	52
Biogás	141	825	267	94	592	188	235	1.417	455
Solar termoelectrica	-	-	-	500	1.298	509	500	1.298	509
<b>TOTAL ÁREAS ELÉCTRICAS</b>	<b>27.032</b>	<b>60.096</b>	<b>5.973</b>	<b>15.462</b>	<b>42.163</b>	<b>7.602</b>	<b>42.494</b>	<b>102.259</b>	<b>13.574</b>
<b>Usos térmicos</b>									
	m <sup>2</sup> Solar T. baja temp.		(ktep)	m <sup>2</sup> Solar T. baja temp.		(ktep)	m <sup>2</sup> Solar T. baja temp.		(ktep)
Biomasa			3.487			583			4.070
Solar térmica de baja temperatura	700.805		51	4.200.000		325	4.900.805		376
<b>TOTAL ÁREAS TÉRMICAS</b>			<b>3.538</b>			<b>907</b>			<b>4.445</b>
<b>Biocarburantes (Transporte)</b>									
<b>TOTAL BIOCARRURANTES</b>			<b>228</b>			<b>1.972</b>			<b>2.200</b>
<b>TOTAL ENERGÍAS RENOVABLES</b>			<b>9.739</b>			<b>10.481</b>			<b>20.220</b>
<b>CONSUMO DE ENERGÍA PRIMARIA (ktep)</b> (Escenario Energético: Tendencial/PER)			<b>141.567</b>						<b>167.100</b>
<b>Energías Renovables/Energía Primaria (%)</b>			<b>6,9%</b>						<b>12,1%</b>

(1): Datos de 2004, provisionales. Para energía hidráulica, eólica, solar fotovoltaica y solar térmica, se incluye la producción correspondiente a un año medio, a partir de las potencias y superficie en servicio a 31 de diciembre, de acuerdo con las características de las instalaciones puestas en marcha hasta la fecha, y no el dato real de 2004. No incluidos biogás térmico y geotermia, que en 2004 representan 28 y 8 ktep.  
(2): En los objetivos de incremento para el periodo 2005-2010, las producciones corresponden a un año medio de acuerdo con las potencias y las características de las instalaciones puestas en marcha durante ese periodo. Para las energías hidráulicas y eólica, sólo la mitad de la potencia instalada en el último año (2010) se ha traducido a producción en las columnas correspondientes.  
(3): Incluye producción con bombeo puro.

Table from page 16

	<b>Año 2010</b>
<b>CONSUMO BRUTO DE ELECTRICIDAD</b>	<b>337.407</b>
<b>Total generación con Renovables (GWh)</b>	<b>102.259</b>
<b>% de Electricidad Renovable s/Consumo Bruto de Electricidad (2)</b>	<b>30,3%</b>

Table from page 17

**Source:** Ministerio de Industria, Turismo y Comercio. (2005). *Plan de energías renovables en España 2005-2010*.

Accessed: 2025-04-17

### 13.3 Plan de Acción Nacional de Energías Renovables (PANER)

*Note: The plan is written in spanish, parts of the text have been translated to english using Google Translate in order to gain a better understanding of the information presented.*

After the binding EU-directive 2009/28/EC Spain adopted the target set in a national policy 2011, Plan de Acción Nacional de Energías Renovables (PANER). In the plan, Spain targets 20% renewable gross final energy consumption for 2020.

**Exact mention:** “Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources sets the general

*objectives of achieving a 20% share of energy from renewable sources in the gross final energy consumption of the European Union (EU) and a 10% share of energy from renewable sources in energy consumption in the transport sector in each Member State by 2020. To this end, it establishes targets for each Member State for 2020 and an indicative minimum trajectory until that year. In Spain, the target is for renewable sources to represent at least 20% of final energy consumption by 2020—the same target as the EU average—along with a 10% contribution from renewable energy sources in transport by that year.” (Google Translate)*

**Source:** Gobierno de España. (2010). *PLAN DE ACCIÓN NACIONAL DE ENERGÍAS RENOVABLES DE ESPAÑA (PANER) 2011 - 2020.*

[https://www.miteco.gob.es/es/energia/estrategia-normativa/desarrollo/energia-renovable/pane\\_r.html](https://www.miteco.gob.es/es/energia/estrategia-normativa/desarrollo/energia-renovable/pane_r.html)

Accessed: 2025-04-01

### **13.4 NREAP - National Renewable Energy Action Plans of the European Member States**

*Note: In Spain's National Renewable Energy action plan several targets were set from 2011 to 2020 (as seen in the table below). The values for 2005 and 2010 are baseline values, the values for 2015 are calculated estimations, therefore these values are not recorded as targets. The Renewable Energy Directive (2009/28/EC)<sup>1</sup> addresses various subjects related to the development of renewable energies in the European Member States, among others the legally binding share of renewable energy in gross final energy consumption. In Article 4 of the Directive each Member State is requested to provide a National Renewable Energy Action Plan (NREAP) by 30 June 2010. Several countries updated their plans in 2011.*

#### 13.4.1 Electricity generation

In the NREAP from 2011 Spain targeted renewable electricity generation for 2020. The targets were the following:

- 39593 GWh hydropower.
- 300 GWh geothermal.
- 29669 GWh solar (subtotal).
- 220 GWh tidal, ocean and wave energy.
- 70502 GWh onshore wind power.
- 7753GWh offshore wind power.
- 10017 GWh from biomass (subtotal).

#### 13.4.2 Gross final electricity consumption

The total target in gross final RES-E (electricity) consumption is also mentioned; 40% or 12903 ktoe.

(Converted to 150,06189 TWh (Unit Juggler, n.d.))

**Exact mention:**

		2005					2010					2015					2020					Page				
		[GWh]	[ktce]	[%] <sup>1</sup>	[%] <sup>2</sup>	[%] <sup>3</sup>	[GWh]	[ktce]	[%] <sup>1</sup>	[%] <sup>2</sup>	[%] <sup>3</sup>	[GWh]	[ktce]	[%] <sup>1</sup>	[%] <sup>2</sup>	[%] <sup>3</sup>	[GWh]	[ktce]	[%] <sup>1</sup>	[%] <sup>2</sup>	[%] <sup>3</sup>					
Renewable production	Electricity																									
	Hydropower < 10 MW	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	75			
	Hydropower 10-100 MW	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	75			
	Hydropower > 100 MW	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	75			
	Hydropower (subtotal)	3550 <sup>1</sup>	3053	66.0	36.2	12.2	3.0	3461 <sup>2</sup>	2977	41.2	23.5	11.9	3.2	3673 <sup>2</sup>	3158	33.1	19.2	11.2	3.3	3993 <sup>2</sup>	3404	26.4	15.4	10.6	75	
	Geothermal	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.1	0.1	0.0	82
	Solar photovoltaic	41	4	0.1	0.0	0.0	0.0	6417	552	7.6	4.3	2.2	0.6	9872	849	8.9	5.2	3.0	0.9	14316	1231	9.5	5.6	3.8	1.3	93
	Concentrated solar power	0	0	0.0	0.0	0.0	0.0	1144	98	1.4	0.8	0.4	0.1	7913	680	7.1	4.1	2.4	0.7	11553	1320	10.2	6.0	4.1	2.4	84
	Solar (subtotal)	41	4	0.1	0.0	0.0	0.0	7561	650	9.0	5.1	2.6	0.7	17785	1529	16.0	9.3	5.4	1.6	29669	2551	19.8	11.6	7.9	2.6	93
	Tidal, wave and ocean energy	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.1	0.1	0.0	80
	Onshore wind	20729	1782	38.5	21.1	7.1	1.8	40978	3523	48.8	27.8	14.1	3.8	56786	4853	51.2	29.7	17.3	5.2	70922	6062	47.0	27.5	18.8	14.2	111
	Offshore wind	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	300	26	0.3	0.2	0.1	0.0	7753	667	5.2	3.0	2.1	0.7	111
	Wind power (subtotal)	20729	1782	38.5	21.1	7.1	1.8	40978	3523	48.8	27.8	14.1	3.8	57086	4909	51.4	29.9	17.4	5.2	78254	6729	52.2	30.5	20.9	14.9	121
Solid biomass	2029	174	3.8	2.1	0.7	0.2	3719	320	4.4	2.5	1.3	0.3	4660	401	4.2	2.4	1.4	0.4	7400	636	4.9	2.8	2.0	0.7	121	
Biogas	623	54	1.2	0.6	0.2	0.1	799	69	1.0	0.5	0.3	0.1	1302	112	1.2	0.7	0.4	0.1	2617	225	1.7	1.0	0.7	0.2	121	
Bio liquids	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0.0	0.0	121	
Biomass (subtotal)	2653	228	4.9	2.7	0.9	0.2	4517	388	5.4	3.1	1.6	0.4	5962	513	5.4	3.1	1.8	0.5	10017	861	6.7	3.9	2.7	0.9	121	
Total (according to Template Tables 10a-f)	53773	4624	100.0	54.8	18.4	4.5	84074	7226	100.0	56.9	28.8	7.8	119988	9543	100.0	58.1	33.8	10.1	150330	12900	60.0	38.5	40.0	13.3	-	
Sum of all technologies (Template Tables 10a-h)	58926	5067	109.6	60.1	20.2	5.0	87673	7539	104.3	59.4	30.1	8.1	117565	10109	105.9	61.6	35.8	10.7	150503	13590	65.3	41.6	42.1	14.0	-	
Gross final RES-E consumption (Template Table 4a)	4624	100.0	54.8	18.4	4.5	-	7227	100.0	56.9	28.8	7.8	-	9545	100.0	58.1	33.8	10.1	-	12903	100.0	58.5	40.0	13.3	64-67		
Geothermal	4	0.1	0.0	0.0	0.0	0.0	4	0.1	0.0	0.0	0.0	0.0	5	0.1	0.0	0.0	0.0	0.0	10	0.2	0.0	0.0	0.0	0.0	726	
Solar thermal	61	1.3	0.7	0.2	0.1	0.1	159	4.2	1.3	0.5	0.2	0.2	308	7.0	1.9	1.0	0.3	0.3	644	11.4	2.9	2.2	0.7	0.7	122	
Solid biomass	3441	96.9	40.8	8.5	3.4	0.8	3550	94.3	28.0	10.6	3.8	0.9	3997	90.8	28.3	12.7	4.2	4.7	4550	85.8	22.0	16.2	5.0	1.0	140	
Biogas	36	1.0	0.4	0.1	0.0	0.0	33	0.9	0.3	0.1	0.0	0.0	63	1.4	0.4	0.2	0.1	0.1	100	1.8	0.5	0.3	0.1	0.1	140	
Bio liquids	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	140	
Biomass (subtotal)	3477	97.9	41.2	8.6	3.4	0.8	3583	95.2	28.2	10.7	3.8	0.9	4060	92.2	28.7	12.9	4.3	4.8	4950	87.5	22.4	16.6	5.1	1.0	140	
Aerothermal heat pumps	4	0.1	0.0	0.0	0.0	0.0	5	0.1	0.0	0.0	0.0	0.0	7	0.2	0.0	0.0	0.0	0.0	10	0.2	0.0	0.0	0.0	0.0	146	
Geothermal heat pumps	4	0.1	0.0	0.0	0.0	0.0	12	0.3	0.1	0.0	0.0	0.0	23	0.5	0.1	0.1	0.0	0.0	41	0.7	0.2	0.1	0.0	0.0	146	
Hydrothermal heat pumps	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	146	
Renewable energy from heat pumps (subtotal)	8	0.2	0.1	0.0	0.0	0.0	17	0.5	0.1	0.1	0.0	0.0	31	0.7	0.2	0.1	0.0	0.0	51	0.9	0.2	0.2	0.1	0.1	146	
Total (according to Template Table 11)	3550	100.0	42.1	8.8	3.5	0.9	3764	100.0	29.7	11.3	4.0	4.0	4404	100.0	26.8	14.0	4.7	4.7	5654	100.0	25.6	18.9	5.8	5.8	-	
Sum of all technologies (Template Table 11)	3550	100.0	42.1	8.8	3.5	0.9	3763	100.0	29.6	11.3	4.0	4.0	4404	100.0	26.8	14.0	4.7	4.7	5655	100.0	25.6	18.9	5.8	5.8	-	
Gross final RES-E consumption (Template Table 4a)	3550	100.0	42.1	8.8	3.5	0.9	3764	100.0	29.7	11.3	4.0	4.0	4404	100.0	26.8	14.0	4.7	4.7	5654	100.0	25.6	18.9	5.8	5.8	64-67	
Transport																										
Bioethanol / Bio-ETBE	113	30.9	1.3	0.3	0.1	0.1	232	12.9	1.8	1.0	0.2	0.2	301	11.2	1.8	1.0	0.3	0.3	400	10.3	1.8	1.3	0.4	0.4	132	
Biodiesel	145	39.6	1.7	0.4	0.1	0.1	1471	81.6	11.6	4.8	1.6	0.6	2169	80.5	13.2	6.9	2.3	2.3	3100	79.8	14.1	9.8	3.2	3.2	138	
Hydrogen from renewables	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	146	
Renewable electricity	10	29.5	1.3	0.3	0.1	0.1	99	5.9	0.8	0.3	0.1	0.1	224	8.3	1.4	0.7	0.2	0.2	381	9.8	1.7	1.2	0.4	0.4	132	
Other biofuels	0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	31	1.0	0.0	0.0	0.0	0.0	4	0.1	0.0	0.0	0.0	0.0	140	
Total (according to Template Table 12)	366	100.0	4.3	1.1	0.4	0.4	1802	100.0	14.2	5.8	1.9	2.0	2695	100.0	16.4	8.6	2.8	2.8	3885	100.0	17.6	12.3	4.0	4.0	-	
Sum of all technologies (Template Table 12)	366	100.0	4.3	1.1	0.4	0.4	1802	100.0	14.2	5.8	1.9	2.0	2695	100.0	16.4	8.6	2.8	2.8	3885	100.0	17.6	12.3	4.0	4.0	-	
Gross final RES-T consumption (Template Table 4a)	366	100.0	4.3	1.1	0.4	0.4	1802	100.0	14.2	5.8	1.9	2.0	2695	100.0	16.4	8.6	2.8	2.8	3885	100.0	17.6	12.3	4.0	4.0	64-67	
RES-T including Article 21.2 (Template Table 4b) <sup>4</sup>	366	100.0	4.3	1.1	0.4	0.4	1852	102.8	14.6	6.0	2.0	2.0	2902	107.7	17.7	9.3	3.1	3.1	4322	111.2	19.6	13.6	4.5	4.5	64-67	
All RES excl. co-operation mech.																										
Gross final RES consumption (Template Table 4a)	8433	100.0	20.0	8.3	3.3	1.3	12693	100.0	41.1	13.6	5.1	1.6	16419	100.0	52.6	17.4	6.4	2.0	2057	100.0	69.6	22.7	14.0	14.0	64-67	
Sum of all technologies (Template Table 11)	8432	100.0	20.0	8.3	3.3	1.3	12693	100.0	41.1	13.6	5.1	1.6	16418	100.0	52.6	17.4	6.4	2.0	2058	100.0	69.6	22.7	14.0	14.0	-	
Gross final RES-E consumption (Template Table 4a)	8432	100.0	20.0	8.3	3.3	1.3	12693	100.0	41.1	13.6	5.1	1.6	16418	100.0	52.6	17.4	6.4	2.0	2058	100.0	69.6	22.7	14.0	14.0	-	
Transfer from other Member States and third countries	n.a.	n.a.	0.0	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	64-67	
Transfer to other Member States	n.a.	n.a.	0.0	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	n.a.	n.a.	0.0	0.0	0.0	0.0	64-67	
All RES incl. co-operation mech.	8433	100.0	20.0	8.3	3.3	1.3	12693	100.0	41.1	13.6	5.1	1.6	16419	100.0	52.6	17.4	6.4	2.0	2057	100.0	69.6	22.7	14.0	14.0	6	

*renewables in Spain by 2030: [between 1 GW and 3 GW] for offshore wind and [between 40 MW and 60 MW] for marine energy.” (page 8)*

**Source:** Gobierno de España. (2022). *Roadmap offshore wind and marine energy in Spain*. [https://www.idae.es/sites/default/files/documentos/idae/tecnologias/energias\\_renovables/eolica/EN\\_HR\\_EOLICA\\_MARINA-PDF\\_ACCESIBLE.pdf](https://www.idae.es/sites/default/files/documentos/idae/tecnologias/energias_renovables/eolica/EN_HR_EOLICA_MARINA-PDF_ACCESIBLE.pdf)

Accessed: 2025-04-01

### **13.6 Plan Nacional Integrado de Energía y Clima (PNIEC 2023-2030)**

*Note:* The plan is written in spanish, parts of the text have been translated to english using Google Translate in order to gain a better understanding of the information presented.

#### 13.6.1 Electricity generation

In 2023 Spain targeted 81% renewable energy (RES assumption: including hydro) electricity generation for 2030. They also target 100% renewable el

**Exact mention:** “*Renewable electricity generation in 2030 will account for 81% of the total...*” (Google Translate, n.d) Page 29.

#### 13.6.2 Installed capacity

In the same report from 2023, Spain also targeted installed capacity of renewable energy sources for 2030. Specifically, Spain targeted:

- 160 GW installed capacity of renewable energy sources (RES assumption: including hydro).
- 62 GW wind power.
- 3 GW offshore wind.
- 76 GW solar power.

**Exact mention:** “*El Plan prevé para el año 2030 una potencia total instalada en el sector eléctrico de 214 GW, de los que 160 GW son de generación renovable...*” (page 29)

## Objetivos sectoriales y por tecnología

2030	PNIEC 2020 / Hojas de ruta	PNIEC 2023
<b>Eólica</b> Incluida eólica offshore	50 GW 1-3 GW	62 GW 3 GW
<b>Solar FV</b> Incluido Autoconsumo	39 GW 9-14 GW	76 GW 19 GW
<b>Hidrógeno renovable: potencia electrolizadores</b>	4 GW	12 GW
<b>Biogás</b>	10,4TWh	20TWh
<b>Almacenamiento</b>	20 GW	22,5 GW
<b>Eficiencia en la edificación. Rehabilitación de viviendas</b>	1.200.000	1.377.000
<b>Vehículo eléctrico</b>	5 millones	5,5 millones
<b>Electrificación (%sobre energía final)</b>	32%	35%
<b>Demanda eléctrica (vs. 2019)</b>	+5%	+34%

Table from page 25

**Source:** Gobierno de España. (2024). *Plan Nacional Integrado de Energía y Clima, ACTUALIZACIÓN 2023-2030*.

Accessed 2025-04-01

### 13.7 NECP - National Energy and Climate Plan

The National Energy and Climate Plan (NECP) is the national strategic guidance tool that integrates energy and climate policy with a time horizon of 2030, in accordance with national and European legislation.

In Spain's NECP report from 2023, the country targets 48 % Gross final energy consumption (RES including hydro) for 2030. This is based on the general EU-target of 45%.

*Note: Aside from this, most targets in the NECP report regard other sectors or are the same as in PNIEC. They are the same reports, just separate Spanish and English versions, the PNIEC communicates a RES-E target and the NECP communicates RES.*

## Exact mention:

Table A.11. Share of renewable energy in final energy consumption in the PNIEC Scenario 2023 – 2030

Share of renewable energy in final energy consumption in the PNIEC Scenario 2023-2030							
	Years172 DER III	2019	2020	2022	2025	2027	2030
Agricultural Consumption (ktoe)	7.1 (b)				159	173	207
EERR for use							
Industry (ktoe)	7.1 (b)				2.239	2.372	2.902
final		4.229	4.116	4.241			
(excluding							
Residential (ktoe)	7.1 (b)				2.281	2.344	2.619
consumption							
Electrical services and other (ktoe)	7.1 (b)				376	414	541
RENEWEL (t)							
Transport (ktoe)	7.1 (C)	1.762	1.536	1.446	2.410	2.986	3.850
Energy delivered by heat pumps (ktoe)	7.1 (b)	849	960	1.211	1.506	1.832	2.561
Renewable electricity generation (ktoe)	7.1 (a)	8.943	9.846	11.736	17.531	20.299	24.451
Total renewable energy (ktoe)	7.1 (a) + (b) + (c)	15.783	16.458	18.633	26.503	30.421	37.295
Final energy corrected by power system losses, aviation consumption and energy supplied by heat pumps (ktoe)	7.5	88.413	77.562	84.251	83.334	81.234	77.925

Table from page 505

**Source:** European commission, Spanish Government. (2024) *Integrated National Energy and Climate Plan UPDATE 2023-2030*.

[https://commission.europa.eu/publications/spain-final-updated-necp-2021-2030-submitted-2024\\_en](https://commission.europa.eu/publications/spain-final-updated-necp-2021-2030-submitted-2024_en)

Accessed: 2025-04-17

## 14 Sweden

### 14.1 En uthållig energiförsörjning- Prop. 1996/97: 84

In 1997 Sweden targeted an addition of 0,5 TWh electricity generation from wind power as well as 0,75 TWh biomass five years after the proposal, in other words by 2002.

#### Exact mention:

*“Målet är att ha en ökad årlig elproduktion från landbaserad vindkraft med 0,5TWh inom fem år. De totala investeringarna för en sådan utbyggnad uppskattas till ca två miljarder kronor.”* In english: *“The goal is to increase annual electricity production from onshore wind power by 0.5TWh within five years. The total investments for such an expansion are estimated at approximately two billion kronor.”*

*"Det gäller såväl nyinvesteringar som konvertering av hetvattenpannor till kraftvärme. En kraftvärmeutbyggnad motsvarande ca 0,75 TWh el per år uppskattas vara möjlig att genomföra under en femårsperiod."Including kraftvärme and elproduktion från biobränslen alltså* In english: *"This applies to both new investments and the conversion of hot water*

*boilers to cogeneration. A cogeneration expansion corresponding to approximately 0.75 TWh of electricity per year is estimated to be possible to implement over a five-year period." Including cogeneration and electricity production from biofuels, that is"*

Sweden had approximately 0,2 TWh wind power in 1997 (Energiföretagen, 2018), which means that Sweden targeted 0,7 TWh wind power in 2002.

**Source:**

Sveriges riksdag, 1996. En uthållig energiförsörjning, prop. 1996/97:84, [https://www.riksdagen.se/sv/dokument-och-lagar/dokument/proposition/en-uthallig-energiforsorjning\\_gk0384/html/](https://www.riksdagen.se/sv/dokument-och-lagar/dokument/proposition/en-uthallig-energiforsorjning_gk0384/html/)

Accessed: 2025-04-17

## **14.2 EU Renewable Electricity Directive (2001/77/EC)**

Directive 2001/77/EC is a European Union Directive for promoting renewable energy use in electricity generation. It is popularly known as the RES Directive. The directive, which took effect in October 2001, sets national indicative targets for renewable energy production from individual member states.

In the EU directive from 2001, the Member States' national indicative targets for the contribution of electricity produced from renewable energy sources to gross electricity consumption by 2010 is stated. For Sweden, the renewable gross final electricity consumption from all renewable energy sources (RES) for 2010 is targeted as 60%.

**Exact mention:**

**Reference values for Member States' national indicative targets for the contribution of electricity produced from renewable energy sources to gross electricity consumption by 2010 (\*)**

This Annex gives reference values for the fixing of national indicative targets for electricity produced from renewable energy sources (RES-E), as referred to in Article 3(2):

	RES-E TWh 1997 (**)	RES-E % 1997 (***)	RES-E % 2010 (****)
Belgium	0,86	1,1	6,0
Denmark	3,21	8,7	29,0
Germany	24,91	4,5	12,5
Greece	3,94	8,6	20,1
Spain	37,15	19,9	29,4
France	66,00	15,0	21,0
Ireland	0,84	3,6	13,2
Italy	46,46	16,0	25,0 (1)
Luxembourg	0,14	2,1	5,7 (2)
Netherlands	3,45	3,5	9,0
Austria	39,05	70,0	78,1 (3)
Portugal	14,30	38,5	39,0 (4)
Finland	19,03	24,7	31,5 (5)
Sweden	72,03	49,1	60,0 (6)

Table from page 7

**Source:** European Parliament & Council of the European Union. (2001). *Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market*. Official Journal of the European Communities, L 283/33.

<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32001L0077&from=en>

Accessed: 2025-04-18

### 14.3 Skr. 2003/04:129

In 2003 Sweden targeted an increase of electricity generation from renewable energy sources (RES incl.hydro) of 10 TWh from the amount in 2002 by 2010.

#### Exact mention:

”Användningen av el från förnybara energikällor skall öka med 10 TWh från 2002 års nivå till 2010.” In english: “The use of renewable energy shall increase with 10 TWh from 2002 to 2010.”

The renewable electricity generation in 2002 was 66,4 TWh (SCB, 2023) creating a target of 76,4 TWh for 2010.

**Source:**

Sveriges regering, 2003. *Regeringens skrivelse 2003/04:129: En svensk strategi för hållbar utveckling – ekonomisk, social och miljömässig*. Retrieved: February, 2025

<https://www.regeringen.se/contentassets/63e668addc0d42e18d9c7de7fdc6f2db/en-svensk-strategi-for-hallbar-utveckling>

Accessed: 2025-04-29

**14.4 2003:113**

In 2003 Sweden targeted an increase of electricity generation from renewable energy sources (RES incl.hydro) of 17 TWh compared to the actual amount in 2002 by 2016.

**Exact mention:**

*“Jämfört med 2002 ökar ambitionsnivån med 17 terawattimmar förnybar el till 2016.”* In english: *“In comparison with 2002 we should aim for 17TWh more RES for 2016.”*

The actual amount in 2002 was 66,4 TWh (as stated above) creating a target of 83,3 (84,4) TWh for 2016.

**Source:**

Regeringskansliet, 2003. Förnybar el med gröna certifikat.

<https://www.regeringen.se/rattsliga-dokument/lagratsremiss/2006/02/fornybar-el-med-grona-certifikat/>

Accessed: 2025-04-29

**14.5 2009/10:NU18**

In line with the EU Directive (2009/28/EC) Sweden in 2009 targeted a national gross final energy target of 49% renewables (RES incl.hydro) for 2020.

**Exact mention:**

*“Förnybartdirektivet syftar till att öka EU:s andel förnybar energi från 8,5 till 20 % under perioden 2005–2020. Genom direktivet upprättas en gemensam ram för främjande av energi från förnybara energikällor.”* In english: *“The Renewable Energy Directive aims to increase the EU's share of renewable energy from 8.5% to 20% over the period 2005–2020. The directive establishes a common framework for the promotion of energy from renewable energy sources.”*

**Source:**

Sveriges riksdag, 2009. Genomförande av direktiv om förnybar energi,

<https://data.riksdagen.se/dokument/GX01NU18>

Accessed: 2025-04-17

## 14.6 Betänkande 2008/09:NU25 - Riktlinjer för energipolitiken

### 14.6.1 Gross final electricity

In 2009 Sweden targeted 50% gross final electricity consumption from renewables for 2020.

### 14.6.2 Electricity generation

In 2009 Sweden targeted 20 TWh of electricity generation from onshore wind as well as 10 TWh from offshore wind in 2020.

#### **Exact mention:**

*“Riksdagen beslutade om nya mål för den svenska energipolitiken. År 2020 ska andelen förnybar energi vara minst 50 procent av den totala energianvändningen...”*

*“Vidare fastställdes en nationell planeringsram för vindkraft till motsvarande en årlig produktionskapacitet på 30 TWh år 2020, varav 20 TWh till lands och 10 TWh till havs.”* In english: *“Furthermore, a national planning framework for wind power was established corresponding to an annual production capacity of 30 TWh by 2020, of which 20 TWh on land and 10 TWh offshore. In addition, the Riksdag said no to a significant number of energy policy motions.”* *“The Riksdag decided on new targets for Swedish energy policy. By 2020, the share of renewable energy shall be at least 50 percent of total energy use...”*

#### **Source:**

Sveriges riksdag. (2009). Riktlinjer för energipolitiken (Bet. 2008/09:NU25).

[https://www.riksdagen.se/sv/dokument-och-lagar/dokument/betankande/riktlinjer-for-energipolitiken\\_gw01nu25/](https://www.riksdagen.se/sv/dokument-och-lagar/dokument/betankande/riktlinjer-for-energipolitiken_gw01nu25/)

Accessed: 2025-04-17

## 14.7 NREAP - Renewable Energy Projections as Published in the National Renewable Energy Action Plans of the European Member States

### 14.7.1 Installed capacity

In the NREAP from 2011 Sweden also targets renewable installed capacity for 2020. The targets used in this project are the following:

- 8 MW = 0,08 GW solar power.
- 4547 MW = 4,547 GW wind power (subtotal).
- 182 MW = 0,182 GW offshore wind power.
- 4365 MW = 4,365 GW onshore wind power.

#### **Exact mention:**

Table 93: Projected wind power electric capacity [MW] for the period 2005 - 2020, broken down into onshore and offshore wind

	Onshore wind				Offshore wind				Total wind power			
	2005 [MW]	2010 [MW]	2015 [MW]	2020 [MW]	2005 [MW]	2010 [MW]	2015 [MW]	2020 [MW]	2005 [MW]	2010 [MW]	2015 [MW]	2020 [MW]
Belgium	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	190	733	2049	4320
Bulgaria	8	336	984	1256	0	0	0	0	8	336	984	1256
Czech Republic	22	243	493	743	n.a.	n.a.	n.a.	n.a.	22	243	493	743
Denmark	2706	2923	2929	2621	423	0	1251	1339	3129	3584	4180	3960
Germany	18415	27526	33647	35750	0	150	3000	10000	18415	27676	36647	45750
Estonia	31	147	400	400	n.a.	n.a.	n.a.	n.a.	250	31	147	400
Ireland	469	2052	2899	4094	25	36	252	555	494	2088	3151	4649
Greece	491	1327	4303	7200	n.a.	n.a.	n.a.	n.a.	300	491	1327	7300
Spain	9918	20125	27847	35000	0	0	150	3000	9918	20125	27997	38000
France	232	2542	10778	19000	0	0	2567	6000	732	2542	13445	23000
Italy	1639	5800	8900	13000	0	0	0	168	1639	5800	9068	12680
Cyprus	0	82	180	300	n.a.	n.a.	n.a.	n.a.	0	82	180	300
Latvia	26	28	104	236	n.a.	n.a.	n.a.	n.a.	180	26	28	104
Lithuania	1	179	389	400	0	0	0	0	1	179	389	400
Luxembourg	35	35	105	131	0	0	0	0	35	35	105	131
Hungary	n.a.	330	577	750	n.a.	0	0	0	n.a.	330	577	750
Malta	n.a.	0	7	15	n.a.	0	0	0	95	0	7	110
Netherlands	1224	1993	4400	6000	0	228	1178	5178	1224	2221	5578	11178
Austria	694	1011	1951	2578	0	0	0	0	694	1011	1951	2578
Poland	121	1100	3350	5600	0	0	0	500	121	1100	3540	6650
Portugal	1063	4256	6100	6000	0	0	25	1063	0	4256	6125	6875
Romania	1	560	3200	4000	0	0	0	0	1	560	3200	4000
Slovenia	0	2	60	106	0	0	0	0	0	2	60	106
Slovakia	5	5	300	5	0	0	0	0	5	5	300	5
Finland	80	n.a.	n.a.	n.a.	0	n.a.	n.a.	n.a.	80	170	670	2500
Sweden	513	1797	3081	4165	23	76	129	182	536	1873	3210	4547
United Kingdom	1351	4040	8710	14930	214	1390	5500	12990	1565	5430	14210	27880
All Member States (total)	39565	81469	125694	164685	685	2541	14320	41324	40440	84913	142922	213379

See Table 96 on page 111 for corresponding wind power electricity production data.

Because for Finland and Belgium no breakdown into onshore and offshore wind power has been specified after 2005 the sum of the subcategories in 2010, 2015 and 2020 is lower than the value for All Member States (total). Poland reports micro-wind separately from onshore wind, which results in a difference between onshore and total capacity.

Table from page 108.

Table 77: Projected solar electric capacity [MW] for the period 2005 - 2020, broken down into photovoltaic (PV) and concentrated solar power (CSP)

	Solar photovoltaic				Concentrated solar power				Total solar electricity			
	2005 [MW]	2010 [MW]	2015 [MW]	2020 [MW]	2005 [MW]	2010 [MW]	2015 [MW]	2020 [MW]	2005 [MW]	2010 [MW]	2015 [MW]	2020 [MW]
Belgium	2	350	713	1340	0	0	0	0	2	350	713	1340
Bulgaria	0	0	220	303	0	0	0	0	0	0	220	303
Czech Republic	1	1650	1680	1695	n.a.	n.a.	n.a.	n.a.	1	1650	1680	1695
Denmark	3	3	4	6	0	0	0	0	3	3	4	6
Germany	1980	15784	34279	51753	0	0	0	0	1980	15784	34279	51753
Estonia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Ireland	n.a.	n.a.	0	0	n.a.	n.a.	n.a.	n.a.	0	0	0	0
Greece	1	184	1270	2200	n.a.	0	30	250	1	184	1300	2450
Spain	60	4021	5918	8167	0	832	3044	5079	60	4653	8666	13445
France	25	504	2151	4860	0	203	560	25	504	2153	5400	5400
Italy	34	2500	5500	8000	0	5	62	600	34	2505	5562	8600
Cyprus	0	6	37	192	0	0	50	75	0	6	87	267
Latvia	n.a.	n.a.	1	2	n.a.	n.a.	n.a.	n.a.	0	0	1	2
Lithuania	0	1	10	10	0	0	0	0	0	1	10	10
Luxembourg	24	27	88	113	0	0	0	0	24	27	88	113
Hungary	n.a.	0	19	63	n.a.	0	0	0	n.a.	0	19	63
Malta	n.a.	4	27	28	n.a.	0	n.a.	n.a.	0	4	27	28
Netherlands	51	92	317	722	0	0	0	0	51	92	317	722
Austria	23	90	179	322	0	0	0	0	23	90	179	322
Poland	0	1	2	3	0	0	0	0	0	1	2	3
Portugal	3	156	540	1000	0	180	500	3	156	720	1500	1500
Romania	0	0	148	260	0	0	0	0	0	148	260	260
Slovenia	0	12	57	139	0	0	0	0	0	12	57	139
Slovakia	0	60	160	300	0	0	0	0	0	60	160	300
Finland	0	0	0	10	0	0	0	0	0	0	0	10
Sweden	4	5	7	8	n.a.	n.a.	n.a.	n.a.	4	5	7	8
United Kingdom	11	50	1070	2680	n.a.	0	0	0	11	50	1070	2680
All Member States (total)	2221	25509	54377	84376	0	637	3573	7044	2221	26146	57949	91419

See Table 80 on page 93 for corresponding solar electricity production data.

Table from page 90.

### 14.7.2 Electricity generation

In the NREAP from 2011 Sweden adopts several renewable electricity generation targets for 2020. The targets used in this project are the following:

- 500 GWh = 0,5 TWh offshore wind power.
- 12000 GWh = 12 TWh onshore wind power.
- 125000 GWh = 12,5 TWh wind power (subtotal).
- 4 GWh = 0.004 TWh solar

### 14.7.3 Gross final electricity consumption

Finally, in the NREAP Sweden targets 62,9% and 97 TWh gross final electricity consumption from renewable energy sources (RES (incl.hydro)) for 2020.

**Exact mention:**

Electricity		2020					
		[GWh]	[ktoe]	[%] <sup>a</sup>	[%] <sup>b</sup>	[%] <sup>c</sup>	[%] <sup>d</sup>
	Hydropower < 1MW	n.a.	n.a.	0.0	0.0	0.0	0.0
	Hydropower 1MW - 10 MW	n.a.	n.a.	0.0	0.0	0.0	0.0
	Hydropower >10MW	n.a.	n.a.	0.0	0.0	0.0	0.0
	Hydropower (subtotal)	n.a.	n.a.	0.0	0.0	0.0	0.0
	Geothermal	68000	5847	69.9	29.7	44.0	14.9
	Solar photovoltaic	n.a.	n.a.	0.0	0.0	0.0	0.0
	Concentrated solar power	4	0	0.0	0.0	0.0	0.0
	Solar (subtotal)	n.a.	n.a.	0.0	0.0	0.0	0.0
	Tidal, wave and ocean energy	4	0	0.0	0.0	0.0	0.0
	Onshore wind	n.a.	n.a.	0.0	0.0	0.0	0.0
	Offshore wind	12000	1032	12.3	5.2	7.8	2.6
	Wind power (subtotal)	500	43	0.5	0.2	0.3	0.1
	Solid biomass	12500	1075	12.9	5.5	8.1	2.7
	Biogas	16635	1430	17.1	7.3	10.8	3.6
	Bioliquids	53	5	0.1	0.0	0.0	0.0
	Biomass (subtotal)	65	6	0.1	0.0	0.0	0.0
	Total (according to Template Tables 10a/b)	16689	1435	17.2	7.3	10.8	3.7
	Sum of all technologies (Template Tables 10a/b)	97258	8363	100.0	42.4	62.9	21.3
	Gross final RES-E consumption (Template Table 4a)	97193	8357	99.9	42.4	62.9	21.3
			8356	99.9	42.4	62.9	21.3

Table from page 235.

#### Source:

European Environment Agency, 2011. *Renewable Energy Projections as Published in the National Renewable Energy Action Plans of the European Member States.*

[https://www.eea.europa.eu/en/analysis/maps-and-charts/national-renewable-energy-action-plan/nreap\\_draft\\_report\\_eea-ecm\\_20100830.pdf/@/@download/file](https://www.eea.europa.eu/en/analysis/maps-and-charts/national-renewable-energy-action-plan/nreap_draft_report_eea-ecm_20100830.pdf/@/@download/file) . Accessed: February of 2025

Accessed: 2025-04-17

#### 14.8 Regeringens proposition 2017/18:228 Energipolitikens inriktning

In 2016 Sweden targeted 100% electricity generation share from renewable energy sources (RES (incl.hydro)) for 2040.

#### Exact mention:

*”Vidare föreslår regeringen att målet år 2040 ska vara 100 procent förnybar elproduktion. Det är ett mål, inte ett stoppdatum som förbjuder kärnkraft och innebär inte heller en stängning av kärnkraft med politiska beslut.”* In english: *“Furthermore, the government proposes that the goal for 2040 should be 100 percent renewable electricity production. It is a goal, not a cut-off date that prohibits nuclear power, nor does it imply the closure of nuclear power by political decision.”*

#### Source:

Sveriges regering, 2016. *Regeringens proposition 2017/18:228, Energipolitikens inriktning.* <https://www.regeringen.se/contentassets/5fe7ecdee2b440eb81348fc722324c91/energipolitikens-inriktning-prop.-201718228> .

Accessed: 2025-02-17

#### 14.9 Sveriges integrerade nationella energi- och klimatplan

This source represents Sweden’s official response to the NECP. Since the NECP does not specify any new or concrete targets, it instead reiterates previously established goals.

#### 14.9.1 Electricity generation

In 2017 Sweden targeted an increase of 18 TWh of electricity generation from all renewable energy sources (RES (incl.hydro)) by 2030.

In 2017 112 TWh Sweden was found to have 159 TWh electricity generation in total with 59 % being renewable (Energimyndigheten, 2018). Calculating the renewable energy and adding the target amounts creates the target used in this report, 112 TWh.

##### **Exact mention:**

*“In June 2017, the Swedish government decided to extend the electricity certificate system until 2045 and to expand the system by 18 TWh until 2030.”* (page 67) (Translated with Google Translate)

#### 14.9.2 Installed capacity

In the same plan, Sweden targeted 2GW installed capacity of solar power as well as 5 GW wind power for 2030.

Sweden was found to have 231 MW = 0,231 GW solar power in 2017 (Bellini, E, 2018), creating a target of 2,231 used in this project. Sweden was found to have 6,611 GW wind power in 2017 (Energimyndigheten, 2017), creating a target of 11,611 GW used in this project.

##### **Exact mention:**

*“The installed capacity of wind power is expected to increase the most, by just over 5 GW between 2017 and 2030. Solar power is expected to increase by just over 2 GW during the same period.”* (Translated with Google Translate) (page 23)

##### **Source:**

Regeringskansliet. (2020). *Sveriges nationella energi- och klimatplan enligt förordningen om styrning av energiunionen och klimatåtgärder* (NECP). Europeiska kommissionen.

[https://energy.ec.europa.eu/system/files/2020-01/se\\_final\\_necp\\_main\\_se\\_0.pdf](https://energy.ec.europa.eu/system/files/2020-01/se_final_necp_main_se_0.pdf)

Accessed: 2025-05-05

#### 14.10 Färdplan 2040

In the plan made in 2021 Sweden targets a future electricity generation of 120 TWh from wind power.

##### **Exact mention:**

*“Dagens bedömningar av den framtida elanvändningen landar kring 200 TWh år 2040. Av detta ser vi att vindkraften kan leverera minst 120 TWh, men vi konstaterar också att potentialen för både efterfrågan och produktion är långt högre än så. Elektrifieringen innebär en enorm energieffektivisering och möjligheterna med framtida tekniker som till exempel elektrobränslen kan antas vara grovt underskattade.”*

**Source:**

SWEA (2021). *Färdplan 2040 - Vindkraft för klimatnytta och konkurrenskraft*  
<https://svenskvindenergi.org/wp-content/uploads/2021/01/Fa%CC%88rdplan-2040-rev-2020.pdf>

Accessed: 2025-05-03

**14.11 Energipolitikens inriktning Prop. 2023/24:NU14**

In 2023 the Swedish government revised the 100% renewable target (14.8) to 100% fossil free electricity generation. This is not taken into account in the project, however, note that the 14.8 target is overturned.

**Exact mention:**

*“Regeringen föreslog i propositionen Vårändringsbudget för 2023 (prop. 2022/23:99) att målet för elproduktionens sammansättning år 2040 ska vara 100 procent fossilfri elproduktion. Riksdagen beslutade i enlighet med regeringens förslag...”* In english: *“The government proposed in the Spring Amendment Budget Bill for 2023 (Bill 2022/23:99) that the target for the composition of electricity production in 2040 should be 100 percent fossil-free electricity production. The Riksdag decided in accordance with the government's proposal...”*

**Source:**

The Swedish Government. (2024). *Energipolitikens långsiktiga inriktning* (Prop. 2023/24:105).

<https://www.regeringen.se/contentassets/2fd0739890d8484b8129d3c0e678f24d/energipolitik-ens-langsiktiga-inriktning-prop.-202324105.pdf>

Accessed: 2025-04-17

**14.12 Sveriges uppdaterade nationella energi- och klimatplan för 2021–2030**

*Note: This document was available as an appendix to a governmental decision from 8 of 27 June 2024.*

In 2024 Sweden targeted 120 TWh of electricity generation from offshore wind power in 2045.

**Exact mention:**

*“Energimyndigheten har på regeringens uppdrag koordinerat arbetet med att identifiera nya områden lämpliga för havsbaserad vindkraft, med målet att möjliggöra för ytterligare 90 TWh årlig elproduktion jämfört med befintliga havsplaner...”* In english: *“On behalf of the Government, the Swedish Energy Agency has coordinated the work of identifying new areas suitable for offshore wind power, with the aim of enabling an additional 90 TWh of annual electricity production compared to existing marine plans...”*

**Source:**

Regeringskansliet, 2024. *Sveriges uppdaterade nationella energi- och klimatplan för*

## 15 Switzerland

### 15.1 Switzerland 2003 review

*Note: The targets presented below were not collected from the original policies but from a review of historical targets in Switzerland published by IEA.*

In 1990 Switzerland targeted two electricity generation share targets for the year 2000. The targets were an increase in the electricity generation share from hydropower with 5% and an increase in electricity generation share from other renewable energy sources (RES excl.hydro) with 0,5 percentage points.

#### Exact mention:

**Table 1**

**Achievement of the Objectives of the Energy 2000 Action Programme**

<i>Area</i>	<i>Target 2000<sup>4</sup></i>	<i>Change 1990-1999<sup>1</sup></i>	<i>Degree of achievement (end of 1999)<sup>4</sup></i>	<i>Change 1990-2000<sup>2</sup></i>	<i>Degree of achievement (end of 2000)<sup>4</sup></i>
Fossil fuel consumption	Stabilisation	+ 7.6%	..	+ 8.9%	not met
Electricity consumption	max. + 16%	+ 10%	..	+ 12.0%	met
Share of renewables (heat)	+ 3 percentage points	+ 37%	65% (+ 1.9 percentage points) <sup>5</sup>	+ 40.1%	70% (+ 2.1 percentage points) <sup>5</sup>
Share of non-hydro renewables (electricity)	+ 0.5 percentage points	+ 74.3%	125% (+ 0.6 percentage points) <sup>5</sup>	+ 84.3%	142% (+ 0.7% percentage points) <sup>5</sup>
Hydropower <sup>3</sup>	+ 5%	+ 4.5%	90%	+ 4.7%	94%
Capacity of existing nuclear plants	+ 10%	+ 7.9%	79%	+ 8.9%	89%

<sup>1</sup> At the end of 1999.

<sup>2</sup> Forecast.

<sup>3</sup> Including plants under construction in 1990.

<sup>4</sup> Compared to 1990 levels.

<sup>5</sup> The number in parentheses indicates the increase in contribution of renewable energy to total heat/electricity production.

Source: *Final Programme Report and 10<sup>th</sup> Annual Report*, DETEC, December 2000.

Table from page 25.

In this source the share of non-hydro renewables in 1990 is stated as 1% and hydropower as 54.6%. See table below.

Unit: Mtoe

DEMAND							
ENERGY TRANSFORMATION AND LOSSES							
	1973	1990	2000	2001	2010	2020	2030
<b>ELECTRICITY GENERATION<sup>8</sup></b>							
INPUT (Mtoe)	4.48	9.39	11.12	11.66	10.07	9.35	7.91
OUTPUT (Mtoe)	3.17	4.70	5.67	6.07	5.22	5.00	4.56
(TWh gross)	36.82	54.62	65.96	70.55	60.73	58.18	53.03
<b>Output Shares (%)</b>							
Coal	-	0.1	-	-	-	-	-
Oil	7.1	0.5	0.1	0.1	0.1	0.1	0.2
Gas	-	0.6	1.5	1.2	1.7	2.2	2.7
Comb. Renewables & Wastes	-	1.0	2.4	2.1	3.2	3.6	4.2
Nuclear	17.1	43.3	40.1	38.0	39.8	36.4	29.6
Hydro	75.8	54.6	55.8	58.6	55.2	57.6	63.2
Geothermal	-	-	-	-	-	-	-
Solar/Wind/Other	-	-	0.0	0.0	0.1	0.1	0.1
<b>TOTAL LOSSES</b>	<b>2.17</b>	<b>5.09</b>	<b>5.92</b>	<b>6.04</b>	<b>5.31</b>	<b>4.81</b>	<b>3.80</b>
of which:							
Electricity and Heat Generation <sup>9</sup>	1.32	4.42	5.10	5.23	4.55	4.06	3.05
Other Transformation	0.14	0.01	-0.03	-0.02	0.00	-	-
Own Use and Losses <sup>10</sup>	0.72	0.66	0.85	0.83	0.76	0.75	0.74
Statistical Differences	-0.02	0.36	-0.62	0.42	-	-	-

Table from page 135

From this, the targets used in this report were calculated. These were 57,33% electricity generation share hydropower and 1,5% RES (excl.hydro) for 2000.

#### Source:

INTERNATIONAL ENERGY AGENCY, (2003), *Energy Policies of IEA Countries SWITZERLAND 2003 Review*,  
<https://iea.blob.core.windows.net/assets/26c54341-bccd-4ef2-992d-318a03c700e9/EnergyPoliciesofIEACountriesSwitzerland2003.pdf>

Accessed: 2025-04-02

## 15.2 Energiegesetz vom 26. Juni 1998

*Note: This document was translated from German using DeepL (DeepL, n.d.), as such the risk of mistranslation exists. The targets were calculated in regards to the base year 2000. The exact methodology will be described with each target.*

### 15.2.1 Electricity generation

In 2009 Switzerland targeted an increase in the average annual renewable electricity generation by at least 5400 GWh by 2030 from all renewable energy sources (RES incl.hydro).

The average annual electricity generation of 2000 was found to be 65348 GWh (International Atomic Energy Agency, 2023). The renewable electricity generation in 2000 was found to be 57% (Macrotrends, n.d.). By calculating the renewable electricity generation and adding the

targeted amount, the target used in this report was calculated to be 42648 GWh renewable electricity generation (RES incl.hydro) for 2030.

**Exact mention:** *“The average annual generation of electricity from renewable energies must be increased by at least 5400 GWh by 2030 compared to the year 2000. The Federal Council may include electricity generated from renewable energies abroad can be counted towards this target up to a share of 10 percent.”*

*Note: The 10% that could be imported to meet the target was not taken into consideration. It was also assumed that the statistics used were correct. In this case it was assumed that the type was RES including hydro.*

### 15.2.2 Electricity generation

In the same document, Switzerland targets an increase in the average annual electricity generation from hydropower by at least 2000 GWh by 2030.

**Exact mention:** *“The average annual generation of electricity from hydropower plants must be by at least 2000 GWh by the year 2030 compared to the level in 2000.”*

The average annual electricity generation of hydropower in 2000 was found to be 37851 GWh (International Atomic Energy Agency, 2023). By adding the targeted amount, the target used in this project was calculated to be 29851 GWh electricity generation from hydropower in 2030.

#### **Source:**

Schweizerische Eidgenossenschaft. 2017-01-01. *Energiegesetz vom 26. Juni 1998 (EnG)* (Revised version from 2016). <https://www.fedlex.admin.ch/eli/cc/1999/27/de>  
Accessed: 2025-03-27

### 15.3 Bundesgesetz über eine sichere Stromversorgung mit erneuerbaren Energien

*Note: This document was translated from German using DeepL (DeepL, n.d.), as such the risk of mistranslation exists.*

In this document from 2023 Switzerland targeted renewable electricity generation for 2035. The targets were the following:

- 35 000 GWh electricity generation from all renewable energy sources except hydropower (RES excl.hydro) for 2035.
- 45 000 GWh electricity generation from all renewable energy sources except hydropower (RES excl.hydro) for 2050.
- 37 900 GWh hydropower for 2035.
- 39 200 GWh hydropower for 2050.

**Exact mention:** *“The production of electricity from renewable energies, excluding hydropower, must amount to at least 35,000 GWh in 2035 and at least 45,000 GWh in 2050.”*

*“The net production of electricity from hydropower must amount to at least 37,900 GWh in 2035 and at least 39,200 GWh in 2050. In the case of pumped storage power plants, only production due to natural inflows is taken into account.”*

*Note: The type for the RES targets was assumed to be excluding hydropower RES(excl. Hydro). For the hydropower targets, the type was assumed to be “hydropower”. The effect of pumped storage mentioned was not taken into account.*

**Source:**

Schweizerische Eidgenossenschaft. 2023-09-29. *Bundesgesetz über eine sichere Stromversorgung mit erneuerbaren.* <https://www.fedlex.admin.ch/eli/fga/2023/2301/de>  
Accessed: 2025-03-28

## **16 Taiwan**

### **16.1 Promotional policy for renewable energy development in Taiwan**

*Note: This source is a scientific article describing historical renewable energy targets from Taiwan. Therefore, this source mentions and describes different policies with different base years. All of the targets are assumed to be regarding installed capacity.*

#### 16.1.1 Installed capacity share

In 1998 in the 1:st National energy conference Taiwan targeted a 3% renewable installed capacity share (RES. incl.hydro) for 2020.

This target was then revised in 2005 in the 2:nd National energy conference where Taiwan also stated other new targets. The installed capacity share targets were 10% renewable installed capacity share (RES. incl.hydro) for 2010 and 12% renewable installed capacity share (RES. incl.hydro) for 2025.

In 2008 in the Framework of Taiwan's Sustainable Energy Policy, Taiwan targeted an 8% renewable installed capacity share for (RES. incl.hydro) 2025.

#### 16.1.2 Installed capacity

The share targets from the 2:nd National energy conference stated above was also communicated as installed capacity. The targets were set as 5000 MW renewable installed capacity (RES. incl.hydro) for 2010 and an interval of 8000 - 9000 MW renewable installed capacity (RES. incl.hydro) for 2025.

Finally in 2009 in the Statute of Renewable Energy Development Taiwan targeted an interval of 6500 – 10 000 MW installed capacity of renewable energy sources (RES incl.hydro) within 20 years, for 2029.

## Exact mention:

**Table 5**  
Transition of renewable-energy target in Taiwan.

Year	Policy decision	Target
1998	1st National Energy Conference	Renewable energy share in the energy supply is <b>3% by 2020</b>
2005	2nd National Energy Conference <sup>a</sup>	Near term: 10% of total power capacity by 2010 <sup>a</sup> (about 5000MW) Long term: 12% of total power capacity by 2025 (about 8000–9000 MW)
2008	Framework of Taiwan's Sustainable Energy Policy	Renewable energy share in the electricity system (capacity) reaches 8% by 2025
2009	Statute of Renewable Energy Development	Subsidies for renewable energy generation capacity by 6500–10,000 MW within 20 years

<sup>a</sup> Also proposed by the conferences of 6th National Science and Technology Conference, 20th Science and Technology Advising Conference, and Nuclear-Free Homeland National Conference.

Table from page 7.

## Source:

J.J. Hwang, 2010. *Promotional policy for renewable energy development in Taiwan.*

<https://www.sciencedirect.com/science/article/pii/S1364032109002603#tbl5fn1>

Accessed: 2025-02-17

## 16.2 Policy for Promoting Renewable Energy & Current Status in Taiwan

*Note: This document was published 2013 but the Renewable Energy Development Act promulgated on July 8 of 2009. The targets presented in the report was set in 2009.*

In the Renewable Energy Development Act from 2009 Taiwan targeted renewable installed capacity for 2012, 2015, 2020, 2025 and 2030. In the project the following targets were used:

- 621 MW onshore wind power for 2012.
- 201 MW solar power for 2012.
- 3683 MW installed capacity in all renewable energy sources (RES incl.hydro) for 2012.
- 7,7% share of renewable installed capacity (RES incl.hydro) for 2012.
- 866 MW onshore wind power for 2015.
- 15 MW offshore wind power for 2015.
- 492 MW solar power for 2015.
- 4314 MW installed capacity in all renewable energy sources (RES incl.hydro) for 2015.
- 10,0% share of renewable installed capacity (RES incl.hydro) for 2015.
- 1200 MW onshore wind power for 2020.
- 600 MW offshore wind power for 2020.
- 1020 MW solar power for 2020.
- 6042 MW installed capacity in all renewable energy sources (RES incl.hydro) for 2020.
- 10,6% share of renewable installed capacity (RES incl.hydro) for 2020.
- 1200 MW onshore wind power for 2025.
- 1800 MW offshore wind power for 2025.
- 2500 MW solar power for 2025.
- 9952 MW installed capacity in all renewable energy sources (RES incl.hydro) for 2025.

- 14,8% share of renewable installed capacity (RES incl.hydro) for 2025.
- 1200 MW onshore wind power for 2030.
- 3000 MW offshore wind power for 2030.
- 3100 MW solar power for 2030.
- 12502 MW installed capacity in all renewable energy sources (RES incl.hydro) for 2030.
- 16,1% share of renewable installed capacity (RES incl.hydro) for 2030.

**Exact mention:**

**Bureau of Energy**  
**Aggressive Installation capacity Targets (MW)**

To prompt the solar PV and off-shore wind power, Taiwan also approved the "Million Solar Rooftop PVs" and "Thousand Wind Turbines" promotion projects. The goals will be to reach the installing of 3,100 MW of PV systems and 1,000 wind turbines ( including 450 on-shore and 600 off-shore wind turbines) by 2030.

Energy Source	2012	2015	2020	2025	2030
On-shore Wind	621	866	1,200	1,200	1,200
Off-shore Wind	0	15	600	1,800	3,000
Hydro Power	2,060	2,052	2,112	2,502	2,502
Solar PV	201	492	1,020	2,500	3,100
Geothermal	0	4	66	150	200
Biogas	9	29	29	31	31
Waste to Energy	792	848	925	1,369	1,369
Ocean Energy	0	1	30	200	600
H2&Fuel Cells	0	7	60	200	500
Total	3,683	4,314	6,042	9,952	12,502
Percentage of installed capacity	7.7%	10.0%	10.6%	14.8%	16.1%

Table from page 3

**Source:**

Bureau of Energy, Ministry of Economic Affairs, Taiwan. (2009). *Policy for promoting renewable energy & current status in Taiwan*. Taiwan.

<https://web.archive.org/web/20160314014936/http://www.mofa.gov.tw/Upload/RelFile/2508/111035/2e9e6ebe-d594-4d46-822b-1110f07f8482.pdf>

Accessed: 2025-02-17

**16.3 Directions for Allocating Installed Capacity of Offshore Wind Potential Zones**

In 2018 Taiwan targeted 5,5 GW installed capacity of offshore wind for 2025.

**Exact mention:** "Directions for Allocating Installed Capacity of Offshore Wind Potential Zones" "MOEA shall execute the following procedures so as to allocate 5.5 GW of installed capacity between 2020 and 2025..." (page 1)

**Source:**

MOEA. 2018. Directions for Allocating Installed Capacity of Offshore Wind Potential Zones.

<https://law.moea.gov.tw/EngLawContent.aspx?lan=E&id=10322&KW=renewable+energy>

Accessed: 2025-02-17

## 16.4 Renewable energy development act

In 2019 Taiwan targeted 27 000 000 kW installed capacity of renewable energy sources (RES incl.hydro) for 2025.

27 000 000 kW = 27 GW

**Exact mention:** “...the promotion objectives for the total amount of electricity generated by renewable energy power generation facility by 2025 is set to be more than 27,000,000 kilowatts. ” (page 2)

### Source:

MOEA. 2019. *Renewable energy act*.

<https://law.moea.gov.tw/EngLawContent.aspx?lan=E&id=10327&KW=renewable+energy>

Accessed: 2025-02-17

## 16.5 12 Key Strategies for Taiwan’s 2050 Net-Zero Transition (Draft) - Key Strategy 3 - Innovative Energy (Geothermal Power Generation/Bioenergy/Ocean Energy)


In 2021, Taiwan targeted installed capacity in renewable energy sources for 2025 and 2030.

The targets were the following:

- 0,1 MW ocean for 2025.
- 1 MW ocean for 2030.
- 778 MW bioenergy for 2025.
- 805 - 1329 MW bioenergy for 2030.
- 20 MW geothermal for 2025.
- 56 -192 MW geothermal for 2030.

*Note: For the targets communicated in the form of an interval, an average value was calculated and used in the project.*

### Exact mention:



	2025	2030
<b>Cumulative Installation Capacity</b>	0.1 MW	1.0 MW
<b>carbon emission reduction*</b>	130 tons	1,300 tons

	2025	2030
<b>Cumulative Installation Capacity</b>	778 MW	805-1,329 MW
<b>carbon emission reduction*</b>	2.06 M tons	2.18-4.00 M tons

Page 29

	2025	2030
<b>Cumulative Installation Capacity</b>	20 MW	56~192 MW
<b>carbon emission reduction*</b>	65,000 tons	18~620,000 tons

Page 29

**Source:**

Bureau of Energy, MOEA (2021). 12 Key Strategies for Taiwan’s 2050 Net-Zero Transition (Draft) Key Strategy 3 - Innovative Energy (Geothermal Power Generation/Bioenergy).

<https://service.cca.gov.tw/File/Get/climatetalks/zh-tw/qyj8WnQEdoUyen3>

Accessed: 2025-02-17

**16.6 12 Key Strategies for Taiwan’s 2050 Net-Zero Transition (Draft) Key Strategy 1 - Wind/Solar PV**

In 2021, as part of the same initiative outlined above Taiwan targeted installed capacity of offshore wind for 2030, 2040 and 2050. The country also targeted annual goals for solar power starting from 2022 leading up to 2030. The targets were the following:

- 382 GW offshore wind for 2030.
- 1129 GW offshore wind for 2040.
- 2002 GW offshore wind for 2050.
- 11 GW solar power for 2022.
- 14 GW solar power for 2023.
- 17 GW solar power for 2024.

- 20 GW solar power for 2025.
- 23,5 GW solar power for 2026.
- 25 GW solar power for 2027.
- 27 GW solar power for 2028.
- 29 GW solar power for 2029.
- 30.5 GW solar power for 2030.

**Exact mention:**

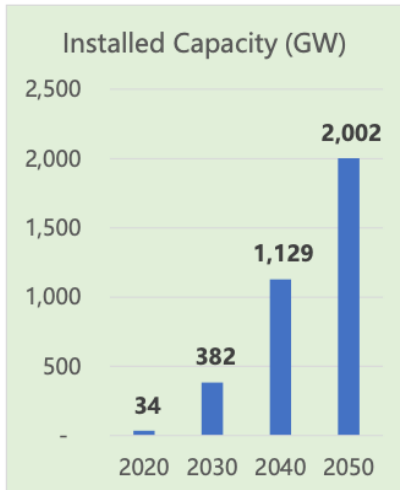


Table from page 3

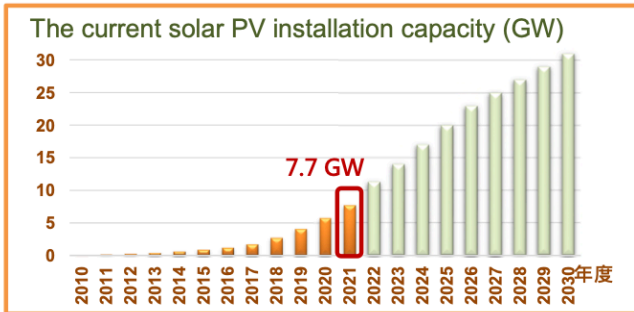


Table from page 8

		Solar PV	
		2025	2030
<b>Cumulative Installed Capacity</b>	20 GW	31 GW	
<b>Annual Carbon Reduction*</b>	12.55 M tons	19.45 M tons	

Table from page 26

*Note: For the targets communicated in the form of an interval, an average value was calculated and used in the project. The data for 2020 is the actual amount and baseline. The*

2030 target for solar power is communicated as both 31 GW and 30,5 GW. For this project, 30,5 GW was used and 31 GW was assumed to be rounded.

**Source:**

Bureau of Energy, MOEA (2021). 12 Key Strategies for Taiwan's 2050 Net-Zero Transition (Draft) Key Strategy 1 – Wind /Solar PV.

<https://service.cca.gov.tw/File/Get/climatetalks/zh-tw/tY19dEWxZZpxKVY>

Accessed: 2025-02-17

## 17 Thailand

### 17.1 Alternative Energy Development Plan: AEDP 2012-2021

*Note: From this source, both new targets are set and old are reestablished. Hence, both targets from 2012 and 2011 are stated down below.*

#### 17.1.1 Installed capacity

In 2011 Thailand targeted renewable installed capacity for 2021. The targets set in the plan were the following:

- 1 608 MW hydropower.
- 1 MW geothermal.
- 2 000 MW solar power.
- 1 200 MW wind power.
- 3 630 MW biomass.

**Exact mention:** *“The government of Thailand, therefore, has currently assigned the Ministry of Energy to set up the 10 Year AlternativeEnergy and Development Plan-AEDP (2011-2021) aiming to create the framework and direction forincreasing alternative energy consumption by 25% in 2021.”*

#### 17.1.2 Primary energy supply

In 2012 Thailand's Ministry of energy targeted a 25% renewable share of primary energy for 2021.

**Exact mention:** *“The government of Thailand, therefore, has currently assigned the Ministry of Energy to set up the 10 Year AlternativeEnergy and Development Plan-AEDP (2011-2021) aiming to create the framework and direction forincreasing alternative energy consumption by 25% in 2021.”*

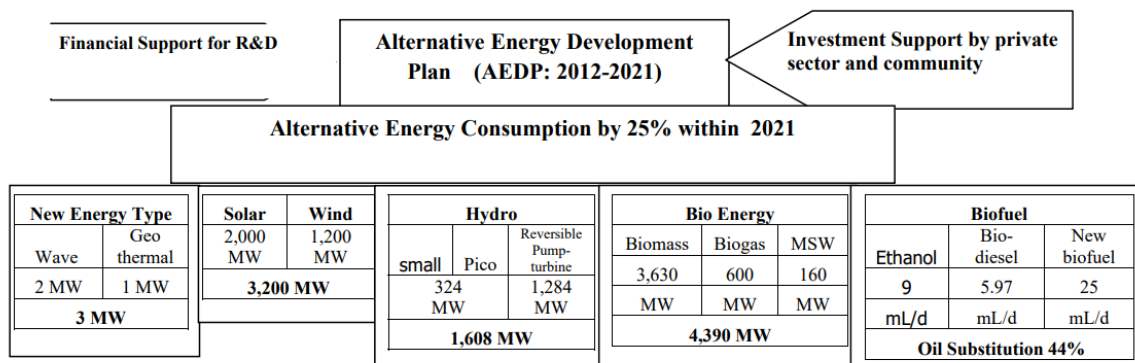


Fig. 3 Development towards Low Carbon Society

Table from page 3

**Source:**

Department of Alternative Energy Development and Efficiency. (2012). *Alternative Energy Development Plan: AEDP 2012-2021*. Page 1,3.

<https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=df4d817115dff7bfbf5769a77c8e43ae672eb7a8>

Accessed: 2025-04-20

**17.2 Thailand’s Alternative Energy Development Plan and the Key Role of Renewables**

17.2.1 Installed capacity

In 2015 Thailand’s Government targeted the following for renewable installed capacity in 2020:

- 3 282 MW hydropower.
- 6 000 MW solar power.
- 3 002 MW wind power.
- 5 570 MW biomass.

17.2.2 Primary energy supply

In the same plan from 2015 Thailand 30% share of renewable primary energy for 2036.

**Exact mention:** “Overall targets: 30% Renewable Energy in total energy consumption by 2036.”

Overall targets: 30% Renewable Energy in total energy consumption by 2036

Power (4.27%)

19,684.4 MW

Heating (19.15%)

25,088 ktoe

Transport (6.65%)

8,712.43 ktoe

1. Municipal Solid Waste	500
2. Industrial waste	50
3. Biomass	5,570
4. Biogas	600
(Waste water/sewage)	
5. Small hydro	376
6. Biogas (Energy crop)	680
7. Wind	3,002
8. Solar	6,000
9. Large hydro	2,906.40

1. Municipal Solid Waste	495
2. Biomass	22,100
3. Biogas	1,283
4. Solar	1,200
5. Alternatives Heat Source*	10

\* Geothermal, pyrolysis oil, etc.

1. Biodiesel (million l/d)	14.0
2. Ethanol (million l/d)	11.3
3. Pyrolysis oil (million l/d)	0.53
4. CBG (ton/d)	4,800
4. Alternative fuels* (ktoe)	10

\* Bio-oil, Hydrogen and others

RE share 14% in 2016

Table from page 5

**Source:**

Yingyuad, R. (2015). *Thailand's Alternative Energy Development Plan and the Key Role of Renewables*. Page 5.

<https://www.irena.org/-/media/Files/IRENA/Agency/Presentations/Regional-focus/2017/Jun/4-DEDE--Thailand-RE--ACEF-6-June-2017--online.pdf>

Accessed: 2025-04-20

## 18 Vietnam

### 18.1 Prime Minister's Decision 2068/QD-TTg

*Note: The document was originally written in vietnamese and therefore it was translated with Google Translate (" signifies text that has been directly translated).*

In this document Vietnam communicates targets for both electricity generation and electricity generation share.

#### 18.1.1 Electricity generation

In 2015, Vietnam set targets for renewable electricity generation for 2020, 2030 and 2050.

The targets used in this project were the following:

- 1 400 000 000 kWh solar power for 2020.
- 35 400 000 000 kWh solar power for 2030.
- 210 000 000 000 kWh solar power for 2030.
- 2 500 000 000 kWh wind power for 2020.
- 16 000 000 000 kWh wind power for 2030.
- 53 000 000 000 kWh wind power for 2050.

- 101 000 000 000 kWh electricity generation from renewable energy sources (RES incl.hydro) for 2020.
- 2030: 186 000 000 000 kWh (RES incl.hydro) for 2030.
- 2050: 452 000 000 000 kWh (RES incl.hydro) for 2040.

**Exact mention:** ‘Electricity produced from solar energy will increase from about 10 million kWh in 2015 to about 1.4 billion kWh in 2020; about 35.4 billion kWh in 2030 and about 210 billion kWh in 2050’

‘Electricity output from wind power sources increases from about 180 million kWh in 2015 to about 2.5 billion kWh in 2020; about 16 billion kWh in 2030 and about 53 billion kWh in 2050’

‘Increase electricity production from renewable energy from about 58 billion kWh in 2015 to about 101 billion kWh in 2020, about 186 billion kWh in 2030 and about 452 billion kWh in 2050.’

*Note: This exact mention was assumed to refer to electricity generation. Based on the exact mention, the source was assumed to be RES (including hydropower).*

### 18.1.2 Electricity generation share

In the same report from 2015, Vietnam targets renewable electricity generation shares:

- 38 % RES (incl.hydro) for 2020.
- 32 % RES (incl.hydro) for 2030.
- 43 % RES (incl.hydro) for 2050.

**Exact mention:** ‘The proportion of electricity produced from renewable energy in the total national electricity production increases from about 35% in 2015 to about 38% in 2020; reaching about 32% in 2030 and about 43% in 2050’

#### **Source:**

2015. Number: 2068/QĐ-TTg. *QUYẾT ĐỊNH: PHÊ DUYỆT CHIẾN LƯỢC PHÁT TRIỂN NĂNG LƯỢNG TÁI TẠO CỦA VIỆT NAM ĐẾN NĂM 2030, TẦM NHÌN ĐẾN NĂM 2050.*

Note: Collected from the ‘II. Development strategy and goals’ & ‘IV. Development orientation by fields’ parts of the document.

<https://luatvietnam.vn/cong-nghep/quyet-dinh-2068-qd-ttg-thu-tuong-chinh-phu-100624-d1.html>

Accessed: 2025-04-20

### **18.2 National Energy Master Plan**

*Note: This document was originally written in vietnamese and therefore it was translated with Google Translate (‘’ signifies text that has been directly translated).*

In 2023 Vietnam targeted intervals of renewable electricity shares (RES incl.hydro) of 30,9-39,2% for 2030 and 67,5-71,5% for 2050.

**Exact mention:** ‘Strongly develop renewable energy sources for electricity production, reaching a rate of about 30.9 - 39.2% by 2030, aiming for a renewable energy rate of 47% if

*receiving strong international financial, technological and governance support according to JETP. Orientation to 2050, the renewable energy rate will reach 67.5-71.5%*

*Note: This exact mention was assumed to refer to electricity generation share. Based on the exact mention, the source was assumed to be RES (including hydropower). Because the targets are communicated as intervals, the targets were later represented by an average value of the lower and upper limits of the intervals.*

**Source:**

2023. Number: 893/QĐ-TTg. *QUYẾT ĐỊNH: Phê duyệt Quy hoạch tổng thể về năng lượng quốc gia thời kỳ 2021 - 2030, tầm nhìn đến năm 2050.* Note: Collected from the ‘III.

Orientation and goals of energy sub-sector planning’ part of the document.

<https://luatvietnam.vn/cong-nghiep/quyet-dinh-893-qd-ttg-2023-quy-hoach-ve-nang-luong-quoc-gia-thoi-ky-2021-2030-261469-d1.html>

Accessed: 2025-04-20

### **18.3 National Power Development Plan**

*Note: The document was originally written in vietnamese and therefore it was translated with Google Translate (‘’ signifies text that has been directly translated).*

In this document Vietnam communicates targets for both electricity generation and installed capacity.

#### 18.3.1 Electricity generation

In 2023, Vietnam targeted an interval of electricity generation generated from solar power for 2050. The target was for 252 100 000 000 - 291 500 000 000 kWh. This target was used as an average value of 271,8 TWh.

**Exact mention:** *‘From now until 2030, the total capacity of solar power sources is expected to increase by 4,100 MW; by 2050, the total capacity is expected to be 168,594 - 189,294 MW, producing 252.1 - 291.5 billion kWh’*

*Note: The part of the exact mention referring to electricity generation was used. Because the target is communicated as an interval, the target was later represented by an average value of the lower and upper limits of the interval.*

#### 18.3.2 Installed capacity

In the same report from 2023, Vietnam targeted renewable installed capacity for 2030 and 2050. The targets were the following:

- 12 836 MW solar power for 2030
- 21 880 MW onshore wind power for 2030
- 60 050 - 77 050 MW onshore wind power for 2050.
- 6 000 MW offshore wind power for 2030,

- 70 000 - 91 500 MW offshore wind power for 2050

**Exact mention:** ‘By 2030: Solar power 12,836 MW (8.5%, excluding existing rooftop solar power), including concentrated solar power sources 10,236 MW, self-produced and self-consumed solar power sources of about 2,600 MW’

‘By 2030, onshore wind power capacity will reach 21,880 MW’ & ‘Orientation 2050: Onshore wind power 60,050 - 77,050 MW’

‘By 2030, offshore wind power capacity serving domestic electricity demand will reach about 6,000 MW; the scale can be increased further in case of rapid technology development, reasonable electricity prices and transmission costs. The target is to reach 70,000 - 91,500 MW by 2050’

*Note: Because the solar power target is communicated as an interval, the target was later represented by an average value of the lower and upper limits of the interval. For onshore and offshore wind power, one of the targets is communicated as an interval, the target was later represented by an average value of the lower and upper limits of the interval.*

**Source:**

2023. Number: 500/QĐ-TTg. *QUYẾT ĐỊNH: Phê duyệt Quy hoạch phát triển điện lực quốc gia thời kỳ 2021 - 2030, tầm nhìn đến năm 2050.* Note: Collected from the ‘III. National power development plan’ part of the document.

<https://luatvietnam.vn/cong-nghiep/quyet-dinh-500-qd-ttg-2023-quy-hoach-dien-luc-quoc-gia-den-2030-252621-d1.html>

Accessed: 2025-04-20

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Number: 893/QĐ-TTg. (2024) *Quyết định: Phê duyệt Quy hoạch tổng thể về năng lượng quốc gia thời kỳ 2021 - 2030, tầm nhìn đến năm 2050.*

<https://luatvietnam.vn/cong-nghiep/quyet-dinh-893-qd-ttg-2023-quy-hoach-ve-nang-luong-quoc-gia-thoi-ky-2021-2030-261469-d1.html>

Number: 2068/QĐ-TTg. (2025) *Quyết định: Phê duyệt chiến lược phát triển năng lượng tái tạo của Việt Nam đến năm 2030, tầm nhìn đến năm 2050.*

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# B

## Appendix II

# APPENDIX II - Additional data points

## 1. Ireland

- 4,17% RES-E (incl.hydro), gross final electricity consumption, 2001.

### Source:

index mundi. (2019-12-28). *Ireland - Renewable electricity output (% of total electricity output)*

[https://www.indexmundi.com/facts/ireland/indicator/EG.ELC.RNEW.ZS?utm\\_source=.com](https://www.indexmundi.com/facts/ireland/indicator/EG.ELC.RNEW.ZS?utm_source=.com)

Accessed: 2025-05-08

- 4,74 GW wind power, installed capacity, 2023.
- 0,72 GW Solar power, installed capacity, 2023.

### Source:

Sustainable Energy Authority of Ireland (SEAI). (2024). *First Look: Renewable Energy in Ireland 2023 Visualising renewable energy data from SEAI's national energy balance.*

<https://www.seai.ie/sites/default/files/data-and-insights/seai-statistics/key-publications/renewable-energy-in-ireland/First-Look-Renewable-Energy-in-Ireland-Report.pdf>

Accessed: 2025-05-08

## 2. Netherlands

- 3.5 % RES (incl. hydro), gross final electricity consumption, 2001. (*Electricity production from hydroelectric sources (% of total) 0.1% + Electricity production from renewable sources, excluding hydroelectric (% of total) 3.4%*)

### Sources:

World Bank Group (n.d.). *Electricity production from hydroelectric sources (% of total) - Netherlands.*

<https://data.worldbank.org/indicator/EG.ELC.HYRO.ZS?locations=NL>

Accessed: 2025-04-04

World Bank Group (n.d.). *Electricity production from renewable sources, excluding hydroelectric (% of total) - Netherlands.*

<https://data.worldbank.org/indicator/EG.ELC.RNWX.ZS?locations=NL>

Accessed: 2025-04-04

### 3. Nigeria

- 20.54 % RES (incl. hydro), electricity generation share, 2023.

**Source:**

Statista (2024). *Share of renewables in total energy production in Nigeria from 2013 to 2023*. <https://www.statista.com/statistics/1481319/share-of-renewables-in-total-power-generation-in-nigeria/>

Accessed: 2025-04-04

### 4. Norway

- 166 GWh solar power, electricity generation, 2023.

**Source:**

Fullständig APA källhänvisning.

Statistiska centralbyrån. (2025). *Fakta om vindkraft*.

<https://www.ssb.no/energi-og-industri/faktaside/vindkraft>

Accessed: 2025-05-08

- 13965 GWh wind power, electricity generation, 2023.
- 137 315 GWh hydropower, electricity generation, 2023.

**Source:**

Statistiska centralbyrån. (2025). *08308: Produksjon av elektrisk kraft (GWh), etter region, statistikkvariabel og år*.

<https://www.ssb.no/statbank/table/08308/tableViewLayout1/>

Accessed: 2025-05-08

### 5. Pakistan

- 27.5% RES(incl.hydro), electricity generation share, 2023

**Source:** Ember. (2025). *Pakistan*. <https://ember-energy.org/countries-and-regions/pakistan/>

### 6. Schweiz

- 1% RES(incl.hydro), electricity generation share, 1990
- 54,6% hydropower, electricity generation share, 1990

**Source:** INTERNATIONAL ENERGY AGENCY, (2003), *Energy Policies of IEA Countries SWITZERLAND 2003 Review*,

<https://iea.blob.core.windows.net/assets/26c54341-bccd-4ef2-992d-318a03c700e9/EnergyPoliciesofIEACountriesSwitzerland2003.pdf>

Accessed: 2025-04-02

- 41,187 TWh hydropower, electricity generation, 2023
- 5,538 TWh RES(excl.hydro), electricity generation, 2023

**Source:** INTERNATIONAL ENERGY AGENCY, nd, *Switzerland- Electricity* ,

<https://www.iea.org/countries/switzerland/electricity>

Accessed: 2025-04-02

## 7. Spain

- 21,15% RES-E (incl.hydro), gross final electricity consumption, 2001.

**Source:**

Macrotrends. *Spain Renewable Energy 1990-2025*.

[https://www.macrotrends.net/global-metrics/countries/ESP/spain/renewable-energy-statistics?utm\\_source=.com](https://www.macrotrends.net/global-metrics/countries/ESP/spain/renewable-energy-statistics?utm_source=.com)

Accessed: 2025-05-08

- 30,718 GW wind power, installed capacity, 2023.
- 24,647 GW Solar power, installed capacity 2023.

**Source:**

Statista. (2024). *Cumulative installed power capacity in Spain in 2024, by technology*.

<https://www-statista-com.eu1.proxy.openathens.net/statistics/1002759/installed-power-capacity-in-spain/>

Accessed: 2025-05-08

- 76 GW RES (incl.hydro), installed capacity 2023.

**Source:**

Statista. (2024). *Installed power capacity from renewable resources in Spain in 2024, by type*.

<https://www.statista.com/statistics/1031674/installed-power-capacity-from-renewable-sources>

[-in-spain/#:~:text=In%202023%2C%20the%20installed%20renewable,of%2024.6%20gigawatts%20in%202023.](#)

Accessed: 2025-05-08

- 22% RES (incl.hydro), gross final energy consumption, 2024.

**Source:**

Santos. (2024-09-23). Spain is One of the World's 15 Largest Clean Energy Consumers But Due to Storage Challenges, Renewable Energy Still Constitutes Only 22% of Spain's Total Energy Consumption. *Climate scorecard*.

<https://www.climatescorecard.org/2024/09/spain-is-one-of-the-worlds-15-largest-clean-energy-consumers-but-due-to-storage-challenges-renewable-energy-still-constitutes-only-22-of-spains-total-energy-consumption/?utm>

Accessed: 2025-05-08

- 50.4% RES (incl.hydro), electricity generation share, 2023.

News statix. (2024-01-22). *Spain Achieves Record 50% Renewable Power Generation in 2023*.

[https://www.newsstatix.com/spain-achieves-record-50-renewable-power-generation-in-2023/?utm\\_source=.com](https://www.newsstatix.com/spain-achieves-record-50-renewable-power-generation-in-2023/?utm_source=.com)

Accessed: 2025-05-08

## 8. Sverige

- 40.8 TWh, Electricity generation, Wind, 2024

Svensk vindenergi, 2025. Många nya vindkraftsrekord under 2024.

<https://svenskvindenergi.org/komm-fran-oss/manga-nya-vindkraftsrekord-under-2024>

Accessed: 2025-05-08

## 9. Vietnam

- 42,3% RES(incl.hydro), Electricity generation share, 2023.
- 25,5 TWh Solar power, Electricity generation, 2023.
- 76,8 TWh Hydropower, Electricity generation, 2023.
- 10 TWh Wind power, Electricity generation, 2023.

**Source:**

EMBER. (2024). *Viet Nam*, <https://ember-energy.org/countries-and-regions/viet-nam/>

Accessed 2025-04-08

- 395 MW Biomass, Installed capacity, 2023.
- 16,568 MWSolar power, Installed capacity, 2023.
- 23,191 MW Hydropower, Installed capacity, 2023.
- 5,059 MW Wind power, Installed capacity, 2023.

**Source:**

MINISTRY OF INDUSTRY AND TRADE . (2024). *VIETNAM RENEWABLE ENERGY DEVELOPMENT STRATEGY UP TO 2030, WITH AN OUTLOOK TO 2050,*

[https://vepg.vn/wp-content/uploads/2024/07/EN\\_REDS\\_I.2-Report-on-REDS-2023\\_Final-1.pdf](https://vepg.vn/wp-content/uploads/2024/07/EN_REDS_I.2-Report-on-REDS-2023_Final-1.pdf)

Accessed 2025-05-08

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