MASTER THESIS REPORT

MASTER OF ENVIRONMENTAL AND ENERGY MANAGEMENT PROGRAMME

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Exploration of future policy and regulatory developments in the EU and the Member states by 2030 regarding Energy and Climate change mitigation, and its implications on Huhtamaki Fiber Packaging

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Finally, I wish to express my gratitude to my family members for their constant support and the LORD for giving me the inspiration and energy to work.

EXECUTIVE SUMMARY

The present research study was conducted to address the key problem identified in the context of the research. In this respect, firstly the key problem was defined and thereafter the research design was developed for deriving the research findings and recommendations.

Problem definition

Under the Paris Agreement, the European Union (EU) aims to reduce the emission of greenhouse gases (GHG) by at least 40% by 2030 compared to 1990. This central goal is translated as national energy and climate targets of the Member States in respect of energy efficiency, renewable energy and GHG emissions. In this respect, the manufacturing companies are witnessing the challenge of meeting the regulatory requirements regarding their energy use and GHG emissions, which shall become more stringent in the next decade (2021-2030).

Research design

Against this backdrop, the research study aimed to explore the regulatory requirements at the EU level and their reflection on the Member States level such as the Netherlands, and their implications on Huhtamaki Fiber Packaging. To achieve the research objective, following central research question was formulated.

Which regulatory requirements with respect to energy and climate change mitigation can be expected at the EU and Member state level and what are the implications of these requirements for Huhtamaki's ambition to become energy sustainable by 2030?

In order to address the central research question, four research sub-questions were formulated dealing with the aspects of supra and national level regulatory framework, energy efficiency, renewable energy and GHG emissions respectively. The research involved critical review of published data, information and documents available on the web sources and provided by Huhtamaki including EU level directives, reports, national plans, compliance reports etc. Additionally, discussions and interviews were conducted with the concerned stakeholders including Dutch Paper industry (VNP), Dutch Emissions Authority (NEa), Netherlands Enterprise Agency (RVO), the Corporate Responsibility (CR) department of Huhtamaki and Managers of Huhtamaki for capturing the requisite information and data and their insights. Accordingly, the findings were derived in respect of each research sub-question and ultimately the central research question.

Key findings

The key findings of the research are represented in *Figure 1*.

EU Level

*** TARGETS (2030):** EE* (32,5%); RE* (32%) & GHG (40%) *(-EU ETS:43% ;Non-EU ETS:30%)*

- 2020: Review of GHG emissions target for increase from 40% to 55%
- 2023: Review of the EE* & RE* targets for increase

FOCUS AREAS

- EE*: -Energy efficiency of the buildings & Energy labels of the products
  (Act for rating of smart readiness of buildings by end of 2019)
- RE*: -RE* in the buildings & Renewable district heating and cooling system
- GHG: -Determining benchmarks by Q2/Q3 of 2020, and thereafter by 2025
  -Determining free emission allowances under EU ETS
  (# Share of free allowances: -Non-CL* sectors: :30% (2021-2026) & reduced to 0% by 2030
  - CL* sectors: 100% benchmarked allocation (upto 2030))

Member States level

*** TARGETS (2030):** Setting own national targets of EE*, RE* & GHG through NECP*

- However, **Must achieve the following**

-EE*: final energy saving of at least 0,8 % each year (2021-2030) & to be achieved through national obligated parties

-RE*: no fixed target, but adequate progress at the reference years 2022, 2025, 2027 & 2030

-GHG: no fixed target, but adherence with EU ETS for ETS companies

•KEY OBLIGATIONS

- Reporting: Development and updating of NECP*, NEEAP* and long-term strategies
- EE* -Energy obligation scheme
  -Promoting energy efficiency of the buildings and products
  (Building automation and control system & Installation of Self-regulating devices)
- RE* -Promotion of RE* in the buildings and renewable district heating and cooling
- GHG - Allocation of free emission allowances for EU ETS 4th trading period (2021-2030)
  - for 1st allocation period (2021-2025) by ***Q3/Q4 of 2020***
  - for 2nd allocation period (2026-2030) by ***2025***

The Netherlands

*** TARGETS (2030)**

- EE*: - Maximum energy consumption of 1950 PJ* (primary) and 1864 PJ* (final) by 2030 & Annual savings of at least 1,5 % of final energy consumption
- RE*: Share of RE of 14% (2020), 16% (2023) & 27-35% (2030)
- GHG: Reduction of 49% by 2030 as compared to 1990 (review of the target by 2020)

•KEY REGULATORY DEVELOPMENTS

- **2019**: Release of final climate agreement & the climate plan (-to be adjusted in 2021 & after 5 years)
- **2019 (Oct)**: Publication of KEV* on annual basis
- **2019 (Dec):** Final NECP* by Dec 2019 & updating by 2024
- **2020:** Preparation of NEEAP*& every 3 years afterwards
- **2020**: Increase of natural gas tax & ODE* tax
- **2021 (Jan):** Amended Environmental Management Act (*Wet Milieubeheer*)
- **2021 (Jan):** Undertaking CO_2 reduction measures by the companies (including RE* & EE* measures)
- **2021 (Jan)**:Levy of national carbon tax on the companies
- **2022 (Q1):** Large scale Nitrogen plant
- **2023 (Jan):** Mandatory energy label for the offices
- **2030**: Phasing out of natural gas production and Closing all coal fired power plants

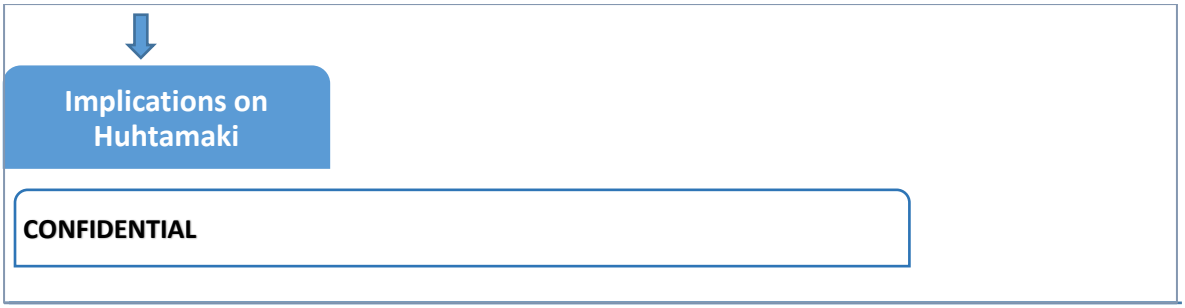

Figure 1- Key findings of the research

*(*EE: Energy efficiency, RE: Renewable energy, NECP: Integrated national energy and climate plan, NEEAP: National energy efficiency action plan, PJ: Petajoules, KEV: Klimaat- en Energieverkenning (National climate and energy outlook),* ODE*: *Opslag duurzame energie* (sustainable energy storage)*)*

EU level

The EU level regulatory requirements have shaped the obligations for the Member States which in-turn lead to the implications on Huhtamaki. At the EU level, the regulatory requirements are driven by the targets of 2030 for energy efficiency (32,5%), renewable energy (32%) and GHG emissions (40%). In order to achieve these targets, the EU aims to promote certain focus areas such as energy efficiency of the buildings and energy related products, renewable energy in the buildings, and renewable and efficient district heating and cooling systems. In order to reduce GHG emissions from EU emission trading sectors (ETS), the EU aims to gradually reduce the free emission allowances and set the ambitious emission benchmarks. Towards this pursuit, several directives are enforced at the Union level which specify obligations for both the EU and the Member States.

Member States level

As a contribution to the EU level targets, the Member States should set their own national targets of 2030 for energy efficiency, renewable energy and GHG emissions depending upon their relative contribution to climate change and economic capacity to undertake measures. However, they must meet certain minimum requirements set by the EC in respect of these targets such as the final energy saving of at least 0,8 % each year (2021-2030) which should be achieved through the national obligated parties. The progress at the level of Member States shall be monitored by the EC through an integrated monitoring and reporting framework. Under this framework, the main reporting documents include climate action progress report, integrated national energy and climate plan (NECP), national energy efficiency action plan (NEEAP) and long-term strategies of the Member States. Furthermore, the Member states should implement national policies and measures for promoting the focus areas of the EU regarding energy and GHG emissions.

Dutch national level (the Netherlands)

Aligned with the Member States level target, the Netherlands aims to achieve the targets of energy efficiency (annual 1,5% energy saving), renewable energy (27-35%) and GHG

emissions (49%) by 2030. In order to achieve these targets, a national level regulatory framework is developed based upon series of agreements including the Energy Agreement (2013), Energy agenda (2016), Coalition agreement (2017) and the national Climate agreement (2019). The important future regulatory developments include release of the climate plan (by 2019), publication of national climate and energy outlook (KEV) on annual basis (by 2019), mandatory CO_2 reduction measures by the industries (by 2021), phasing out the natural gas production from Groningen (by 2030) and closing of all coal-fired plants (by 2030). Furthermore, other significant regulatory requirements include increase of natural gas tax from 2020, levy of national carbon tax on the industries from 2021 and mandatory energy label for offices by 2023.

Implications on Huhtamaki
<CONFIDENTIAL>

Key Recommendations

In cognizance of the fact that development of regulations is a dynamic process, Huhtamaki is recommended to liaison with the concerned national competent authority to track the regulatory requirements on a periodic basis. Furthermore, the national and EU level developments should be timely pursued by review of amendments in the relevant EU level directives, reports and national plans including NECPs, NEEAPs, long-term strategies of the Member States, national climate agreement, national climate plan and KEV.

Furthermore, several measures may be adopted for achieving CO_2 reduction including process efficiency, energy saving, electrification, use of blue and green hydrogen, carbon capture and storage etc. In this respect, the potential funding opportunities may be explored under the government schemes such as SDE+ subsidy scheme and the Energy Innovation Demonstration Scheme (DEI) in case of the Netherlands. Besides, the information and advice may be obtained from the national competent authority on renewable alternatives as well as available incentives. Alongside, technological innovations such as technologies including Alcohol as carrier and Foam forming, and Deep Eutectic Solvents (DES) system may be experimented if feasible, for increasing the process and energy efficiency.

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ACRONYMS LIST

EU: The European Union
EC: the European Commission
UN: United Nations
EE: Energy Efficiency
RE: Renewable Energy
GHG: Greenhouse gases
ETS: Emissions Trading System
CCS: Carbon capture and storage
CL: Carbon leakage
NDC: Nationally determined contribution
VNP: *Koninklijke vereniging van nederlandse papier-en karton-fabrieken* (Dutch paper industry)
NEa: *Nederlandse Emissieautoriteit* (Dutch emissions authority)
RVO: *Rijksdienst voor Ondernemend Nederland* (Netherlands enterprise agency)
NECP: Integrated National Energy and Climate Plans
NEEAP: National Energy Efficiency Action Plan
KEV: *Klimaat- en Energieverkenning* (National climate and energy outlook)
MEE: *Meerjarenafspraak energie-efficiëntie (*Long-Term Agreement for Energy Efficiency)
LTA-3: Long-Term Agreement 3
ODE: *Opslag duurzame energie* (Sustainable energy storage)
PJ: Petajoules
Mtoe: Million Tonnes of Oil Equivalent

1 INTRODUCTION

1.1 CONTEXT

The energy sector faces the inter-wined challenges of climate change and energy security which demand reducing reliance on fossil fuels by the development of innovative solutions. These concerns have guided policymakers to formulate global, regional and national level policies and regulations for stimulating the energy transition. In this context, the most notable development is the Paris Agreement (2015) under which 195 countries agreed for a long-term goal of keeping the increase in global average temperature to well below 2°C above pre-industrial levels *(European Comission, 2019)*. Towards this pursuit, the countries have submitted their nationally determined contribution (NDC) to achieve this long-term goal. The European Union (EU) aims to reduce the emission of greenhouse gases (GHG) by at least 40% by 2030 compared to 1990, under its wider 2030 climate and energy framework *(European Comission, 2019).*

The above ambition of EU has shaped the policies and regulations of the EU as well as the Member States with respect to energy and climate change mitigation. The Member States are obliged to set national targets for 2030 to achieve the EU level targets of reduction in GHG emissions, energy efficiency and renewable energy. Notably, to achieve these targets, the manufacturing companies are bound to play a vital role on account of their high energy consumption and greenhouse gas emissions.

Problem definition

The manufacturing companies are increasingly witnessing the challenges of meeting regulatory requirements and stakeholder expectations regarding their energy consumption and GHG emissions. These challenges shall manifest themselves on a larger scale in the next decade (2021-2030) due to stringent regulations and rising expectations. For instance, in the case of the Netherlands, all the Dutch companies must become 10% most CO_2 efficient[1] companies in Europe in their sector by the year 2030 *(Dutch Government, 2019, Climate Agreement, C3.3.7c, P.102, Para.3).* In this context, it is imperative for the companies, particularly, the large companies to anticipate the future regulatory developments regarding energy and climate change mitigation at the EU and the member states level and assess the future implications on their energy use. This shall enable them to implement long term strategies to become energy sustainable by 2030.

Against this backdrop, the present research study focussed upon Huhtamaki Fiber Packaging, a global food packaging company, on account of its deep commitment towards energy sustainability and wide geographic presence in the EU region. This was positively

[1] It refers to the amount of CO_2 emissions per unit production and is assessed in terms of achieving the relevant benchmark defined under EU Emission Trading System (*Dutch Government, 2019)*.

complemented by its willingness and support for conducting the research to assess the above-mentioned challenges.

About the Company

Huhtamaki Fiber Packaging is a leading producer of packaging and shape packaging from recycled fibers having 11 production locations all across the globe *(Huhtamaki, 2019c)*. In Europe, there are four production locations in the countries the Netherlands, Northern Ireland, France, and the Czech Republic. The products offered include egg cartons, fruit trays, wine carriers, cup carriers and protective buffers for consumer electronics and other products. The company relishes in the guiding principles of sustainability and renewable resources throughout its supply and production chain.

The raw material used for production includes recycled paper and grass fibers from natural resources *(Huhtamaki, 2019b)*. The standard production processes are represented in *Figure 1-1*. The energy-intensive processes include pulp preparation and drying, while the direct GHG emissions [2] mainly result from the dryers through the combustion of natural gas for generation of heat. Under the study, the analysis of Huhtamaki Fiber packaging was conducted for EU region from the perspective of energy efficiency (under Section 3.3), renewable energy (under Section 4.3) and GHG emissions (under Section 5.3) respectively. It may be noted that in the report Huhtamaki Fiber Packaging is referred to as Huhtamaki while Huhtamaki company is referred to as Huhtamaki group.

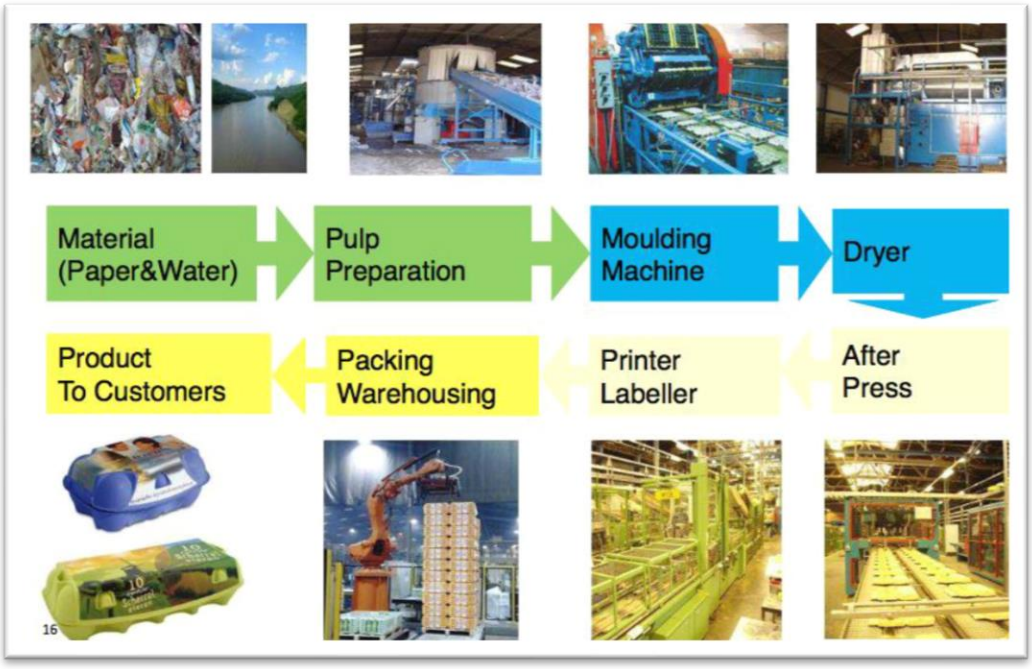


Figure 1-1 Standard production processes of Huhtamaki Fiber packaging
(Source: (Huhtamaki, 2019b))

[2] Direct GHG emissions occur from the sources within the premises of the company *(WRI and WBCSD, 2011).*

1.2 RESEARCH DESIGN

As the core of research design, firstly the research objectives were defined. In order to address the research objectives, a central research question and four research sub-questions were formulated. Thereafter, the scope of research was delineated and a research framework along with the methodology was developed for answering the research questions. The following sections describe the research objectives, research questions, scope of research, research framework and methodology adopted for the research study.

Research Objectives

The research study aimed to achieve the following objectives.

i. To explore future regulatory developments in the EU for the period 2021-2030 regarding energy efficiency, renewable energy, and climate change mitigation and assess their reflection at the level of member countries
ii. To assess the general implications of these developments on the production locations of Huhtamaki Fiber packaging in the EU region

Research Questions (RQ)

In line with these objectives, the following central question was formulated.

Which regulatory requirements with respect to energy and climate change mitigation can be expected at the EU and Member state level and what are the implications of these requirements for Huhtamaki's ambition to become energy sustainable by 2030?

The above central question was addressed by answering the following sub-questions.

I. What is the regulatory framework with respect to energy and climate change mitigation at the EU level and how is it reflected at the member state level such as the Netherlands?
II. What are the future (anticipated) requirements regarding energy efficiency at the EU level and how are these requirements reflected at the Member state level such as the Netherlands, and implied for Huhtamaki Fiber packaging?
III. What are the future (anticipated) requirements regarding the use of renewable energy at the EU level and how are these requirements reflected at the Member state level such as the Netherlands and implied for Huhtamaki Fiber packaging?
IV. What are the future (anticipated) requirements regarding GHG emissions at the EU level and how are these requirements reflected at the Member state level such as the Netherlands and implied for Huhtamaki Fiber packaging?

Scope of Research

The study covered four production locations of Huhtamaki Fiber packaging in the EU region, as indicated in *Table 1-1*. The study was mainly based upon EU level analysis of regulations while the national level analysis of the regulations was carried out in the case of the

Netherlands (as an example of a Member State). Furthermore, the study covered those regulations relevant for the manufacturing companies falling under the EU Emissions Trading System[3] (EU ETS) considering that Huhtamaki is a part of EU ETS. Regarding the requirements about GHG emissions, the research focused upon the aspect of allocation of GHG emission allowances which acts as the central factor for reducing GHG emissions. It is also important to note that the Brexit effect on the obligations of the EU and the Member States was not accounted for.

Table 1-1 List of production locations covered under the research

S. No	Production Location	Reporting Segment
1	Franeker, The Netherlands	Fiber packaging
2	l'Ile d'Elle, France	Fiber packaging
3	Pribyslavice, Czech Republic	Fiber packaging
4	Dollingstown, Northern Ireland	Fiber packaging

Source:(Huhtamaki, 2019c)

Research Framework

The study employed the research framework as illustrated in *Figure 1-2*. It involved both desk research and primary research with the focus on the assessment criteria. The assessment criteria were based upon three parameters namely Energy efficiency, Renewable energy, and direct GHG emissions. The application of assessment criteria followed the reverse pyramid approach under which the parameters were assessed from highest to lowest levels namely EU, the Member states, the Netherlands and Huhtamaki Fiber Packaging. Under the results of the analysis, firstly the supra and national-level regulatory framework were assessed which govern and guide the regulations regarding the three parameters. Thereafter based on this framework, the requirements regarding energy efficiency, renewable energy, and GHG emissions were derived at different levels. Finally, the recommendations were provided based on the results of the analysis.

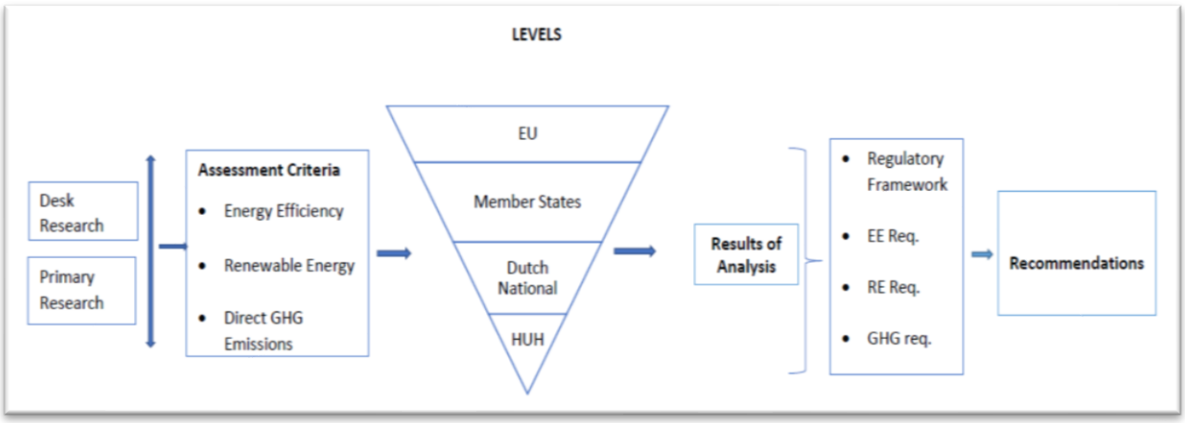


Figure 1-2 Research Framework
***(Abbreviations**: HUH: Huhtamaki; EE: energy efficiency; RE: renewable energy, Req.: requirements)*

[3] A brief description about the functioning of EU ETS is provided under *Annexure 1.*

Methodology

The study was conducted under the advice of Huhtamaki's office in the Netherlands which also served as the point of contact for the other production locations and other stakeholders covered under the study. At the commencement of the study, extensive desk research was carried out to gather and analyse information and data relevant to the research questions. Besides, the gaps and discrepancies in the available information and data were identified for obtaining clarifications from the concerned stakeholders. Afterward, primary research was conducted involving interviews with the concerned stakeholders which focussed upon capturing the insights and requisite information and data. Notably, desk research was concurrently conducted during the entire study duration in order to validate the information and data as well as acquire the updated information and data. In the end, the findings of the research were structured and analyzed to allow for answering the research questions.

The specific methodology followed in respect of each research question is mentioned in the respective chapters of the research questions, which are Chapter 2 (for RQ-I), Chapter 3 (for RQ-II), Chapter 4 (for RQ-III) and Chapter 5 (for RQ-IV). The brief details about desk research and primary research are mentioned below.

Desk Research

The desk research involved a critical review of published data, information and documents available on the web sources and provided by Huhtamaki. The complete list of literature covered under the study is provided under Bibliography.

The important documents which were reviewed during the study are given below.

- EU level directives regarding renewable energy, energy efficiency and GHG emissions *(refer Annexure 2)*
- The fourth report on the State of the Energy Union
- Draft integrated national energy and climate plan of the Netherlands (2021-2030) dated 6 November 2018
- Dutch National Energy Efficiency Action Plan (2017-2020) and Annual Report (2018)
- Dutch national Climate agreement (*Klimaatakkord*) dated 28 June 2019
- Internal documents provided by Huhtamaki such as energy data, emissions data and compliance reports

Primary Research

The study was conducted under the guidance of Professor (associate) energy innovation at the University of Twente and Global Energy Manager of Huhtamaki, in the role of supervisors. Accordingly, the study entailed regular discussions with the supervisors for obtaining clarifications on certain aspects and their recommendations. Additionally, other concerned stakeholders were also covered, as mentioned in *Table 1-2*, through semi-structured interviews *(S. No. 1 to 4*), email communication and open discussion.

Table 1-2 List of stakeholders interviewed

S. No.	Stakeholders
1	*Koninklijke vereniging van nederlandse papier-en karton-fabrieken* (VNP) **(-Dutch paper industry)**
2	*Nederlandse Emissieautoriteit* (NEa) (-**Dutch Emissions Authority**)
3	*Rijksdienst voor Ondernemend Nederland* (RVO) (-**Netherlands Enterprise Agency**)
4	Corporate Responsibility (CR) Department of Huhtamaki
5	Manager QEHS Huhtamaki Franeker
6	Senior Energy, Drying & Process Engineer at Huhtamaki
7	TQM Manager at Huhtamaki Czech Republic

Before conducting the interviews, a questionnaire was prepared for discussion and shared with the interviewees after obtaining approval from the supervisors. The minutes of the stakeholder interviews are provided under *Annexure 3*.

1.3 DEFINITION OF KEY CONCEPTS

The definitions of key concepts used in the study are provided under *Annexure 4*.

1.4 READERS' GUIDE

The report is divided into six chapters, with Chapter 1 being the introductory chapter and Chapters 2, 3, 4 and 5 addressing the research questions I, II, III and IV respectively. Based on the findings of the Chapters from 2 to 5, conclusions and recommendations are drawn in Chapter 6. Chapter 2 describes the regulatory framework for the period 2021-2030 at the EU level and Dutch national level which encompasses the aspects of energy efficiency, renewable energy and GHG emissions. The regulatory framework is assessed in terms of the energy and climate targets, and the guiding requirements for achieving these targets. Based on this framework, the specific requirements regarding energy efficiency, renewable energy, and GHG emissions are assessed under Chapter 3, 4 and 5 respectively. Therefore, Chapter 2 serves as the foundation of the research and should be read in conjunction with the subsequent Chapters.

2 THE SUPRA AND NATIONAL REGULATORY FRAMEWORK ABOUT ENERGY AND CLIMATE CHANGE MITIGATION

This chapter describes the regulatory framework for the period 2021-2030 at the EU level (Section 2.1) and Dutch national level (Section 2.2) which encompasses the aspects of energy efficiency, renewable energy and GHG emissions. The regulatory framework is assessed in terms of the energy and climate targets, and the guiding requirements for achieving these targets. Notably, as mentioned under the scope of the research, this chapter covers those regulations which bear relevance with the manufacturing companies falling under the EU Emissions Trading System[4] (EU ETS).

2.1 EU LEVEL AND THEIR REFLECTION ON THE MEMBER STATES

As the starting point, the regulatory framework of the EU is presented below.

Energy and climate targets at the EU level

In line with the commitment under the Paris Agreement, the European Commission (EC) has defined the future energy and climate targets for short-term (2020), medium-term (2030) and long-term (2050) basis under three fundamental frameworks *(European Comission, 2019*). The targets defined under these frameworks are depicted in *Figure 2-1.*

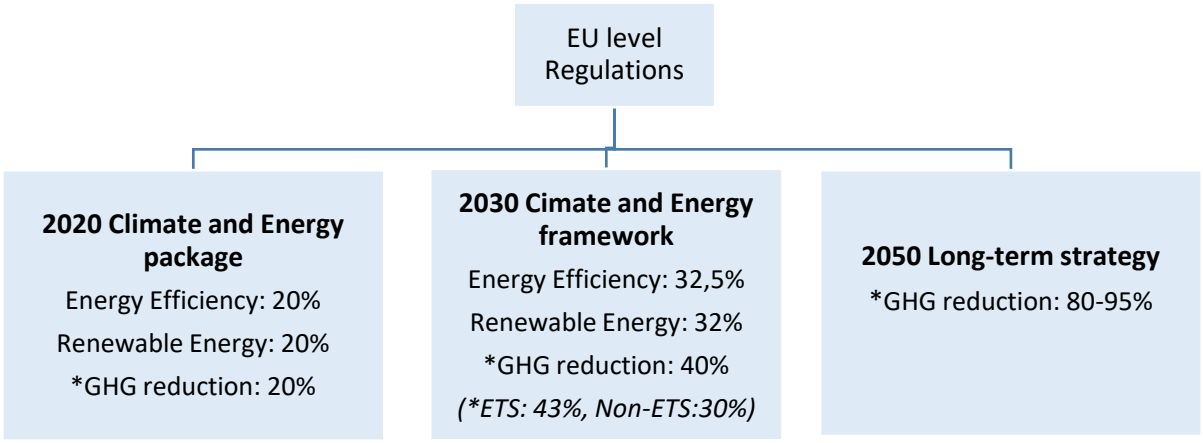


Figure 2-1 Future energy and climate targets of the EU

*(*GHG-Greenhouse gas emissions, ETS: Emission trading sector)*

*(**Source**: European Commission, 2018b)*

2020 climate and energy package

It aims to achieve the following targets by 2020 at the EU level *(European Commission, 2009).*

- 20% improvement in energy efficiency, as compared to the projection made in 2007
- 20% share of renewables in the final energy consumption
- 20% reduction in GHG emissions, as compared to 1990

[4] A brief description about the functioning of EU ETS is provided under *Annexure 1.*

2030 Climate and energy framework

Under this framework, the EU must achieve the following targets by the year 2030 *(European Commission, 2018a).*

- At least 32,5% improvement in energy efficiency, as compared to the projection made in 2007
- At least 32% share of renewables in the final energy consumption
- At least 40% cuts in GHG emissions, from 1990 levels

The EU level targets shall be achieved through the allocation of separate targets to the Member States and the sectors. Considering allocation for the Member States, they are accorded flexibility in determining their national targets depending upon their relative contribution to climate change and economic capacity to undertake measures *(European Commission, 2018i).* With respect to sector-wise allocation, the EU ETS sector needs to attain 43% reduction in GHG emissions (compared to 2005) by 2030, while for the non-ETS sector a target of 30% reduction in GHG emissions (compared to 2005) needs to be achieved (*European Commission, 2019c*). Henceforth, from the perspective of a company, the energy and climate targets are influenced by the member country and the sector (EU ETS or non-ETS) in which it operates.

2050 long-term strategy

It lays down a roadmap to a competitive low-carbon economy by 2050, to achieve the agreed objective of an 80-95% GHG emission reduction by 2050 *(European Commission, 2018b)*. It also emphasizes that an 80% reduction in GHG emissions can be achieved through cost-competitive domestic measures alone.

Guiding requirements at the EU level

In order to achieve the future energy and climate targets, the EC has enforced several directives at the Union level which lay down specific obligations for the EU and the Member States. The key directives include the following.

- Governance of the Energy Union and Climate Action *(Regulation (EU) 2018/1999)*
- Energy Efficiency Directive *(Directive (EU) 2018/2002)*
- Renewable Energy Directive *(Directive (EU) 2018/2001)*
- EU ETS directive *(Directive (EU) 2018/410)*

Under the study, a total of 10 EU directives are reviewed, the list of which is provided under *Annexure 2*. Accordingly, the guiding requirements for the EU with regard to energy and climate targets of 2030 are indicated in *Figure 2-2.* The specific requirements for the EU and the Member States regarding energy efficiency, renewable energy, and GHG emissions are assessed under *Section 3.1*, *Section 4.1* and *Section 5.1* respectively.

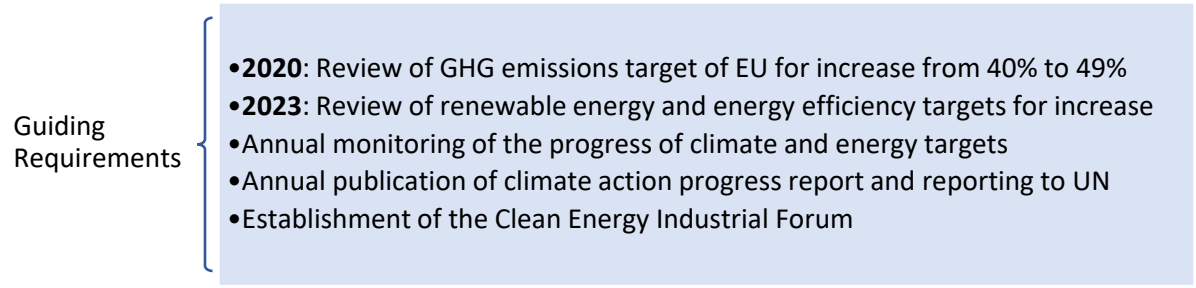


Figure 2-2 Guiding requirements for EU regarding energy and climate change mitigation

*(**Source**: Various EU level directives)*

Notably, the EU level targets of 2030 as mentioned in *Figure 2-1* shall be reviewed by the EC in the intermediate years for a possible increase. In respect of GHG emissions target, it shall be reviewed by 2020 for an increase from 40% to 55% based on the proposal put forward by the Dutch cabinet *(Dutch Government, 2019, Climate Agreement, Section A, P.4, Para 2).* Besides, a provision is also made for the increase in energy efficiency and renewable energy targets by the year 2023 *(European Commission, 2018a).*

Furthermore, to ensure the achievement of the targets, an integrated monitoring and reporting system has been established by the EC. The progress at the Member State level shall be monitored through the annual State of the Energy Union report as well as the European Semester (*European Commission, 2018a)*. The State of the Energy Union should also provide policy conclusions for each Member State. Accordingly, the EU should undertake an annual publication of climate action progress report and regular reporting to the UN. Additionally, the EC has established the Clean Energy Industrial Forum for exchanging the knowledge among industry representatives, academia, local authorities, and policymakers *(European Commission, 2019d*).

REFLECTION ON THE MEMBER STATES

The EU level regulatory framework is reflected at the Member States level in terms of certain obligations for them. Nonetheless, it is important to note that these requirements are generally advisory in nature and should be fulfilled through the national regulations of the respective Member States.

Energy and climate targets for the Member States

As mentioned earlier, the Member States are accorded freedom to determine their national targets depending upon their specific circumstances. Notwithstanding, they must meet certain minimum requirements regarding their energy and climate targets as mentioned in *Table 2-1*.

Table 2-1 Energy and Climate targets for the Member States

Parameter	Target
Energy efficiency	No fixed country-level gross target for 2030, however, Annual savings of at least 0,8 % of final energy consumption during 2021-2030
Renewable energy	No fixed country-level target, however, the progress of target achievement should be: - 18% (by 2022) - 43% (by 2025) - 65% (by 2027) -100% (by 2030)
GHG	No fixed country-level target, however, adherence with EU ETS i.e., Max. emissions from ETS companies = free allocated emission allowances

*(**Source**: Various EU level directives)*

With respect to energy efficiency, the Member States except Cyprus and Malta must achieve a minimum annual savings of 0,8 % of absolute final energy consumption averaged over the most recent three-year period prior to 1 January 2019 for the entire obligation period 2021 to 2030 *(European Commission, 2018f, Directive (EU) 2018/2002,, Article 7.1, P.8).* For renewable energy, there is no minimum country-level target defined by the EC, however the Member States should attain adequate progress in achieving their target which should be at least 18% (by 2022), 43% (by 2025), 65% (by 2027) and 100% (by 2030) *(European Commission, 2018i, Regulation (EU) 2018/1999, Article 4a.2, P.18).* Further, considering GHG emissions there is no minimum country-level target defined by the EC, however, the Member States should ensure that the maximum emissions from ETS companies are below their allocated free emission allowances *(Dutch Emissions Authority, 2019).*

Guiding requirements for the Member States

In order to achieve the future energy and climate targets, the Member States should fulfil certain guiding requirements as indicated in *Figure 2-3*, which are stipulated by the EU level directives.

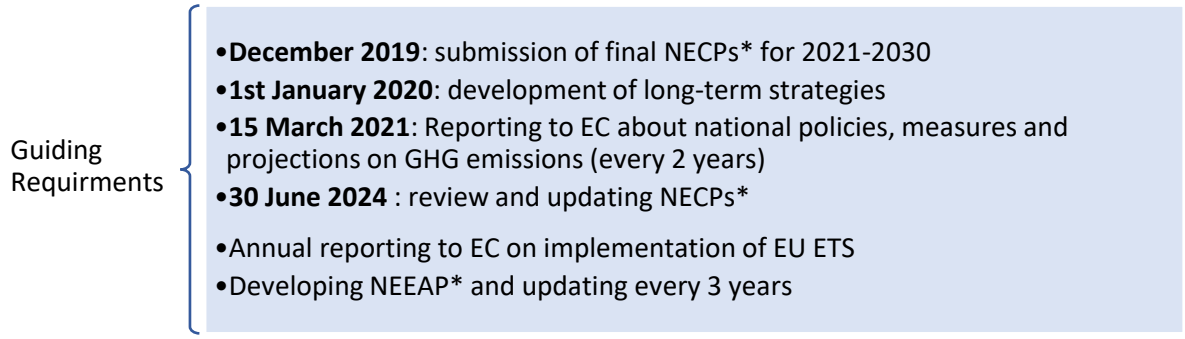


Figure 2-3 Guiding requirements for the Member states

*(*NECP: Integrated National Energy and Climate Plans; NEEAP: National Energy Efficiency Action Plan)*

*(**Source**: Various EU level directives)*

The Member States should provide their national energy and climate targets as well as the strategies in the integrated national energy and climate plans (NECPs) *(European Commission, 2017a).* These plans should be developed for a ten years period (2021-2030) covering the following five dimensions of the Energy Union based on a common template.

- Energy security
- Internal energy market
- Energy efficiency
- Decarbonization
- Research, innovation, and competitiveness

As stated by the EC, Member States have submitted their draft plans for 2021-2030 to the Commission and shall submit their final plans by the end of 2019 after receipt of recommendations by EC. Furthermore, the member states should develop national long-term strategies consistent with their NECPs, by 1 January 2020. The NECPs shall further be reviewed and updated by the Member States by 30 June 2024 to reflect achievement of the 2030 targets for energy and climate *(European Commission, 2018i, Regulation (EU) 2018/1999, Point 34, P.6).*

Additionally, the Member States should submit the National Energy Efficiency Action Plan (NEEAP) every 3 years and submit the report on an annual basis *(Dutch Government, 2017).* NEEAPs should provide information about estimated energy consumption, planned energy efficiency measures, and the expected improvements. In this context, the member countries have submitted the plans for 2017-2020, and the next plans shall be prepared for 2021-2023. The Member States should also report to the EC about the national policies, measures and projections on GHG emissions every 2 years with effect from 15 March 2021, as well as report annually on implementation of EU ETS *(European Commission, 2018i, Regulation (EU) 2018/1999,Article 18.1, P.26); (European Commission, 2013).*

2.2 DUTCH NATIONAL LEVEL (THE NETHERLANDS)

In order to fulfil the obligations as a Member State, the Netherlands has adopted a national-level regulatory framework for the period 2021-2030. It is based upon a series of agreements including the Energy Agreement (2013), Energy agenda (2016), Coalition agreement (2017) and the National Climate agreement[5] (2019).

Energy and climate targets of the Netherlands

The national targets of energy efficiency, renewable energy and GHG emissions for the period 2021-2030 are provided in *Table 2-2.*

[5] It is an agreement among five sectoral tables including Electricity, Built Environment, Industry, Agriculture and Land use, and Mobility under the umbrella Climate Council *("Nieuwsbericht | Klimaatakkoord," 2019)*

Table 2-2 Energy and Climate targets of the Netherlands

Parameter	Target
Energy efficiency	-Maximum energy consumption of 1950 PJ* (primary) and 1864 PJ* (final) by 2030 - Annual savings of at least 1,5 % of final energy consumption (2021-2030)
Renewable energy	Share of renewable energy - 14% (by 2020) - 16% (by 2023) -27 to 35% (by 2030)
GHG	Reduction of 49% by 2030 as compared to 1990

*(*PJ- Petajoules)*

*(**Source:** Various national level agreements and plans)*

In respect of energy efficiency, the Dutch government has set two targets, first being achievement of a maximum energy consumption of 1950 Petajoules (PJ) (primary) and 1864 PJ (final) by 2030 and second being annual energy savings of at least 1,5 % of final energy consumption *(Dutch Government, 2018a, draft NECP,Clause 1.1 iii, P.8,Para.4); (Dutch Government, 2017, NEEAP, Clause 3.1.1, P.9, Para.3).* For renewable energy, intermediate targets are set for the share of renewable energy which are 14% in 2020, increasing to 16% in 2023 and 27-35% by 2030 *((RVO, 2014, Energy Agreement,P.5); (Dutch Government, 2018a, draft NECP, Clause 1.1 iii, P.8, Para.4).*

Regarding GHG emissions, the Government aims to achieve a 49% reduction in the emissions by 2030 as compared to 1990 *(Dutch Government, 2019, Climate Agreement, Section A, P.4, Para 2*). However, in case of increase in the EU wide target from 40% to 55% as mentioned under *Section 2.1*, the final target of the Netherlands for 2030 may deviate from 49% *(Dutch Government, 2019, Climate Agreement, Section A, P.4, Para 2*).

Guiding regulatory developments in the Netherlands

Several regulatory developments shall occur in the Netherlands during the period (2021-2030), as indicated in *Figure 2-4*. They shall act as the catalyst and guide towards the achievement of the energy and climate targets. The specific requirements regarding energy efficiency, renewable energy and GHG emissions at the Dutch national level are assessed under *Section 3.2*, *Section 4.2* and *Section 5.2* respectively.

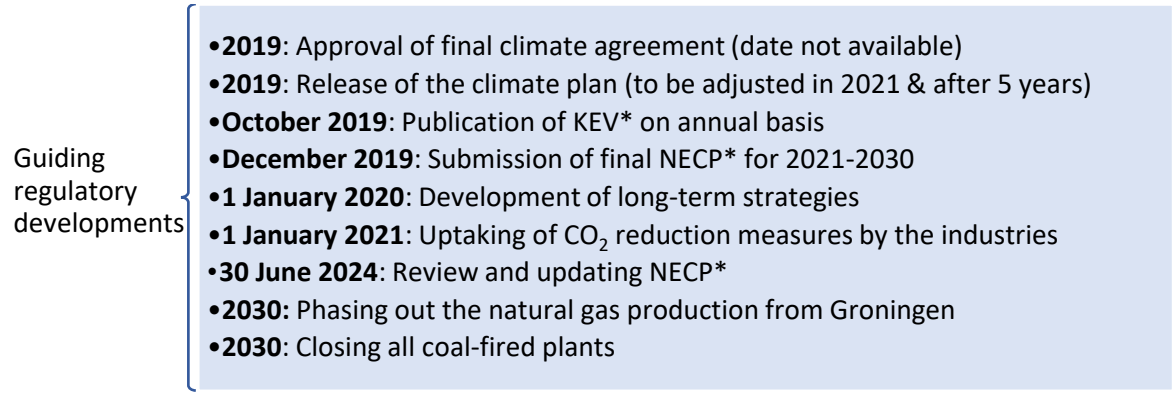


Figure 2-4 Guiding regulatory developments in the Netherlands

*(*KEV: National climate and energy outlook, NECP: Integrated National Energy and Climate Plans)*

*(**Source:** Various national level agreements and plans)*

The national climate agreement was published by the Cabinet on 28 June 2019 and shall be finalized after approval by the Parliament *("Nieuwsbericht | Klimaatakkoord," 2019).* The date by which the climate agreement shall be approved by the Parliament is not available as on date. Based on the climate agreement, a climate plan shall be formulated which would outline the government policies to be pursued for the period 2021-2030 *(Dutch Government, 2019, Climate agreement, Section- B4, P.11, Para 3).* It further specifies that the first Climate Plan shall be released in 2019, which can be adjusted in 2021 and will be redefined at least once every five years.

Moreover, it states that the Climate and Energy Outlook (KEV) will be published annually from October 2019 and will report on the expected CO_2 emissions in 2030 and expected future developments. As mentioned under Section 2.1, the Dutch government shall also submit the final NECP by December 2019 which shall be reviewed and updated by 30 June 2024 *(European Commission, 2018i, Regulation (EU) 2018/1999, Point 34, P.6).* Additionally, the Dutch government shall develop national long-term strategies consistent with the NECP, by 1 January 2020.

From the perspective of manufacturing industries, the most significant measures include a decrease in the production of natural gas from Groningen and fully phasing out by 2030 and closing all coal-fired plants by 2030 *(Dutch Government, 2018a, draft NECP, Section 4.4.1, P.89; Section 1.2.i, P.9, Para.5).* The government expects the companies to set high sustainability ambitions and undertake fundamental research, development of pilot projects and implementation to achieve these ambitions *(Dutch Government, 2016b)*. In this respect, the companies shall be mandatorily required to undertake CO_2 reduction measures having a payback period of 5 or fewer years from 1 January 2021 under amended Environmental Management Act (*Dutch Government, 2019, Climate agreement, Section-C3.3.4, P.93, Para.1).* Further, to reduce CO_2 emissions the industry may adopt measures such as process efficiency, energy-saving, electrification, use of blue and green hydrogen, carbon capture and storage (CCS), the circularity of products, etc. The guidelines of this act shall be drawn in close consultation with industry and small and medium enterprises (SMEs) and will be submitted to the Lower House (*Tweede Kamer*) before 1 July 2020 *(Dutch Government, 2019, Climate agreement, Section C3.3.4, P.93).*

Additionally, to facilitate uptake of carbon reduction measures, the government shall provide in time the necessary permits and infrastructure facilities for both individual investment plans and projects in clusters *(Dutch Government, 2019, Climate agreement, Section C3.3.7, P.100 Para.2)*. A task force will also be set up by the end of 2019 that shall identify and advise on the infrastructural needs, especially in the clusters *(Dutch Government, 2019, Climate agreement, Section C3.3.7, P.103, Para.6)*. Furthermore, financial support shall be extended through SDE+ subsidy scheme and the Energy Innovation Demonstration Scheme (DEI) *(Dutch Government, 2019, Climate Agreement, Section C3.3.8 P.104 & Section C5.8, P.179, Para.1).*

To summarize, the findings of this Chapter provide the answer to the 1st Research Question which deals with the regulatory framework at the EU level regarding energy and climate change mitigation during the period (2021-2030) and its reflection on the Member state level such as the Netherlands. The summary of the key findings is represented in *Figure 2-5.*

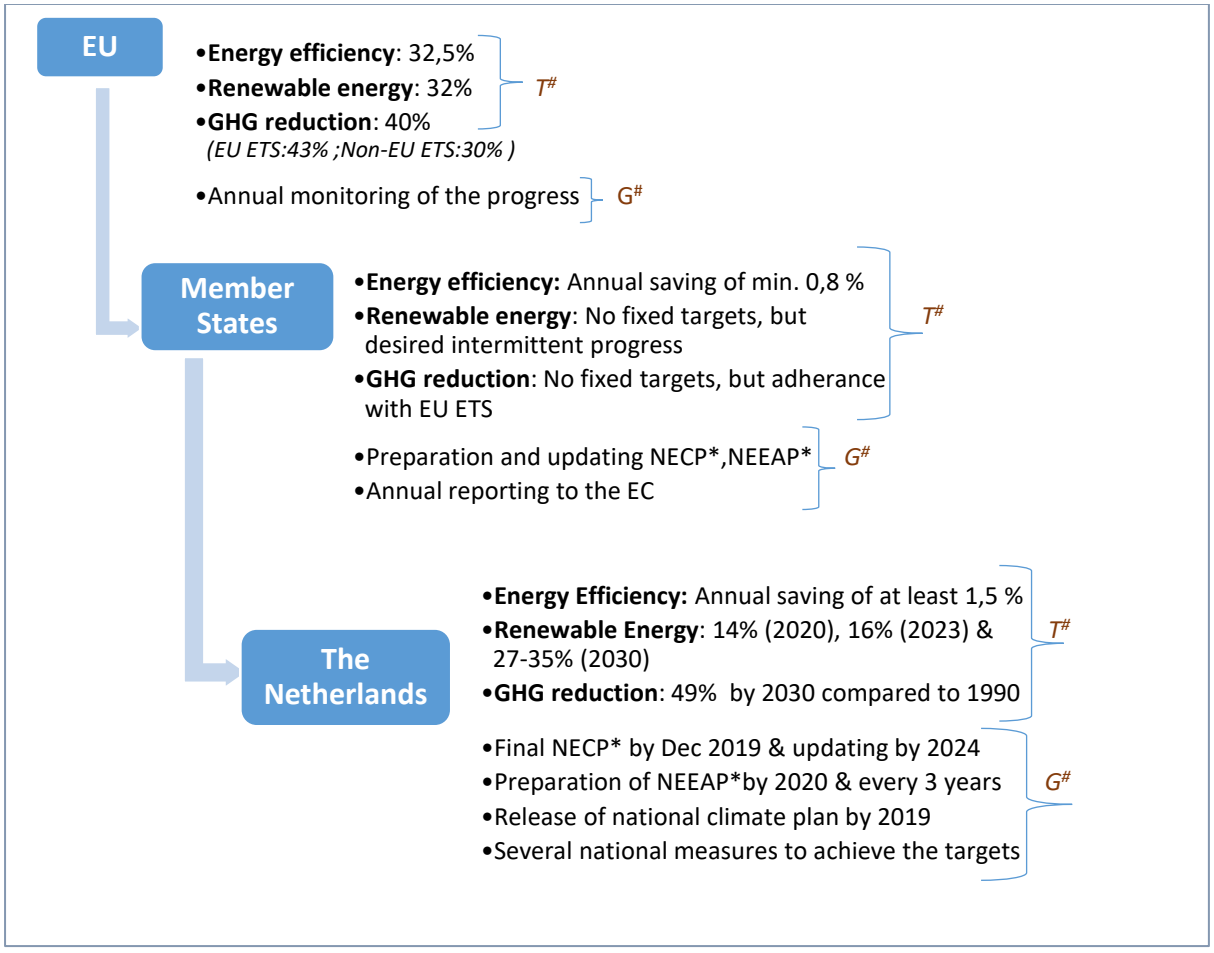


Figure 2-5 Regulatory Framework Summary

(T#: Energy and climate targets of 2030; G#: Key guiding requirements;

**NECP: Integrated national energy and climate plan, NEEAP: National energy efficiency action plan)*

To this end, it is observed that the regulatory framework is built upon the energy and climate targets, and the guiding requirements for achieving these targets. At the EU level, targets are defined in respect of energy efficiency, renewable energy and GHG emissions which are then allocated to the Member States and different sectors. In the case of the Member States, flexibility is accorded in setting their own targets depending upon their relative contribution to climate change and economic capacity to undertake measures. Nonetheless, they must meet certain minimum targets as defined by the EC. Considering sectorial allocation, the GHG emission target is allocated between ETS sectors, which are monitored at the EU level and non-ETS sectors which are monitored at the national level.

In order to achieve the targets, several directives are enforced at the Union level which specifies obligations for both the EU and the Member States. The key directives include Governance of the Energy Union regulation, Energy Efficiency Directive, Renewable Energy Directive and EU ETS directive. In this respect, integrated monitoring and reporting framework are established under which the Member States should report to the EC about their targets, achievements, and strategies on a periodic basis. The main reporting documents include climate action progress report, integrated national energy and climate plan (NECP), national energy efficiency action plan (NEEAP) and long-term strategies of the Member States.

At the Dutch national level, a national level regulatory framework is developed on the basis of a series of agreements including the Energy Agreement (2013), Energy agenda (2016), Coalition agreement (2017) and the National Climate agreement (2019). The targets of energy efficiency, renewable energy, and GHG emissions are defined. Further, several regulatory developments shall occur in the Netherlands during the period (2021-2030) for achievement of the targets. The important developments include release of the climate plan (by 2019), publication of national climate and energy outlook (KEV) on annual basis (by 2019), CO_2 reduction measures by the industries (by 2021), phasing out the natural gas production from Groningen (by 2030) and closing of all coal-fired plants (by 2030).

3 FUTURE (ANTICIPATED) REQUIREMENTS REGARDING ENERGY EFFICIENCY BY 2030

This chapter describes the future requirements regarding energy efficiency for the period 2021-2030 at the level of European Union (EU) and their reflection on the Member States (under Section 3.1) and Dutch National level (under Section 3.2). The implications of these requirements on Huhtamaki are analyzed under Section 3.3. Notably, this chapter covers those regulations which bear relevance with the manufacturing companies under the EU Emission Trading System (ETS).

3.1 EU LEVEL AND THEIR REFLECTION ON THE MEMBER STATES

The key requirements regarding energy efficiency for the period 2021-2030 are firstly assessed at the EU level which is the topmost level. These requirements are derived from the regulatory framework discussed in Section 2.1. The key requirements are indicated in *Figure 3-1* and are mainly governed by the following EU directives.

i. Governance of the Energy Union and Climate Action Regulation *(Regulation (EU) 2018/1999)*
ii. Energy Efficiency Directive *(Directive (EU) 2018/2002)*
iii. Energy Labelling Directive *(Directive (EU) 2017/1369)*
iv. Energy Performance of Buildings Directive *(Directive (EU) 2018/844)*

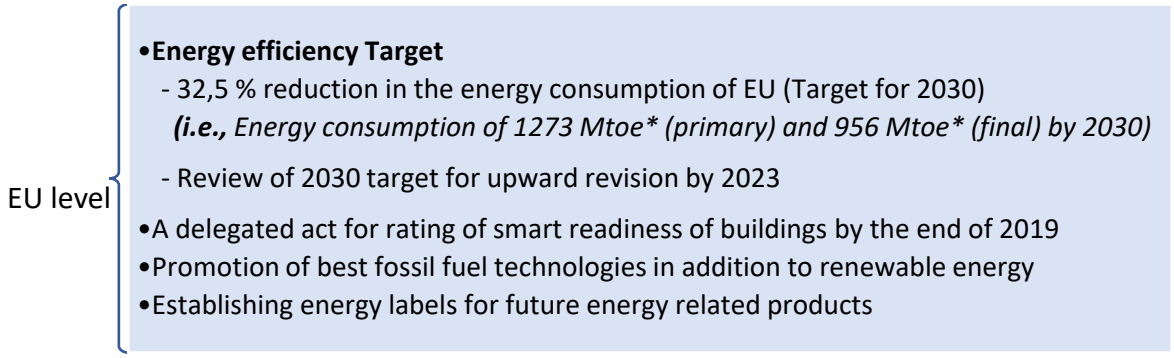


Figure 3-1 Energy efficiency requirements at EU level

(Mtoe: Million Tonnes of Oil Equivalent)*

(Source: European Commission directives)

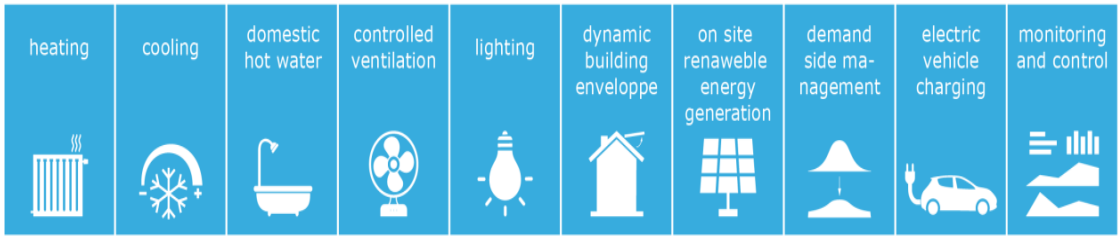
As the central requirement, the EU must achieve the target of at least 32,5 % reduction in the primary[6] and final energy consumption[7] by 2030 as compared to their projection made in 2007 *(European Commission, 2018f, Directive (EU) 2018/2002, Point.6, P.2)*. This means that the maximum primary energy consumption and the final energy consumption of the EU should be 1273 Million Tonnes of Oil Equivalent (Mtoe) and 956 Mtoe respectively, in the year 2030. Notably, this target shall be considered for increase by the European Commission (EC) during

[6] 'Primary energy consumption' is defined as the total inland consumption *(European Commission, 2012).*

[7] 'Final energy consumption' means primary energy consumption excluding the energy consumption by the energy transformation sector and the energy industries themselves *(European Commission, 2012).*

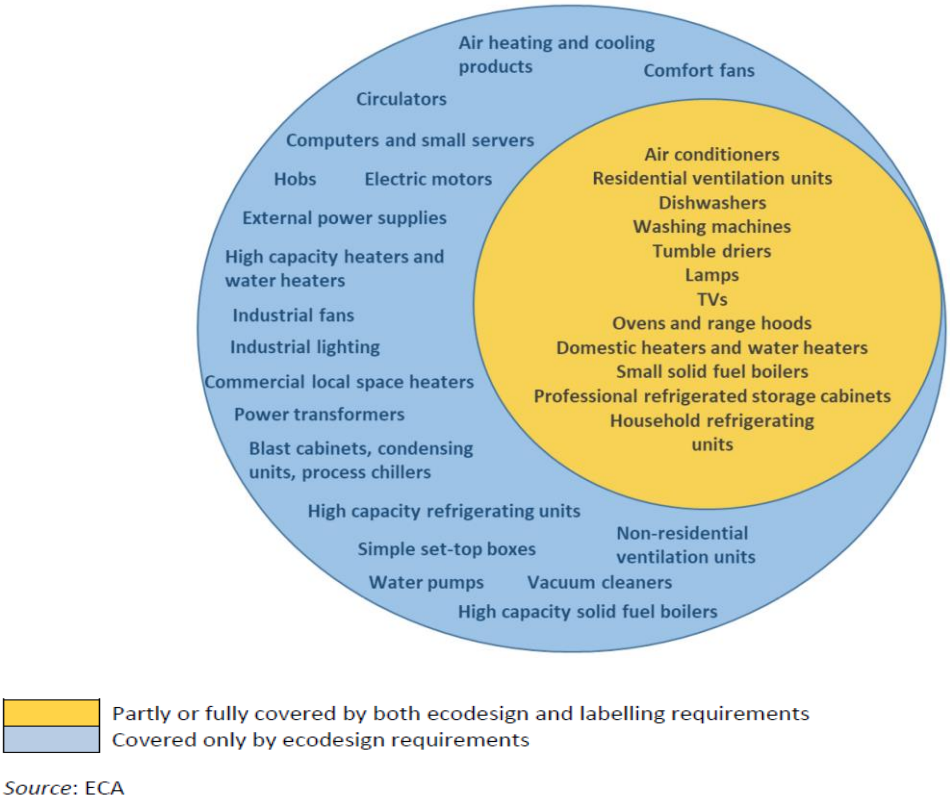
2023 in the case of substantial cost reductions or, the need to meet the Union's international commitments for decarbonization.

To achieve the target, the EC emphasizes on the aspects of energy efficiency of the building and energy efficiency of the energy-related products. In this respect, the EC shall adopt a delegated act by 31 December 2019 for establishing an optional common Union scheme for rating the smart readiness of the buildings *(European Commission, 2018h, Directive (EU) 2018/844, Article 8.10, P.10).* The rating shall be based on an assessment of the capabilities of a building or building unit to adapt its operation to the needs of the occupant and the grid and to improve its energy efficiency and overall performance. The smart readiness indicator (SRI) score shall be developed for the building based on 10 domains as indicated below *(European Commission, 2018j).*



Moreover, the EC shall continue promoting renewable energy technologies as well as best fossil fuel technologies for space and water heating products under EU energy labelling scheme *(European Commission, 2017b).* The EC shall prepare a long-term working plan for the revision of energy labels[8] for energy-related products and also provide an indicative list of future energy-related products for which an energy label could be established *(European Commission, 2017b, Regulation (EU) 2017/1369, Point 36, P.6).* The working plan was prepared for the period 2016-2019 and the next plan shall be prepared for the period 2020-2023 *(European Commission, 2016).* The list of product categories which are currently covered under energy labelling scheme and those which shall be considered for the period 2020-23 is provided under *Figure 3-2 (European Court of Auditors, 2019)*.

[8] The energy labelling aims to provide consumers with relevant information regarding energy consumption by a product when in use, as well as supplementary information about its environmental performance *(European Court of Auditors, 2019).*



Source: ECA

Figure 3-2 List of product categories under EU energy labelling scheme

REFLECTION ON THE MEMBER STATES

The requirements at the level EU are reflected as specific obligations for the Member States which are represented in *Figure 3-3*. However, it is important to note that most of these requirements are guiding in nature and should be fulfilled by the Member States through their national regulations.

Member States

- Energy efficiency Target of 2030
  - Setting own national target of total % reduction in energy consumption by 2030
  - Must achieve final energy saving of at least 0,8 % each year (2021-2030)
  - Updating the NEEAP* every 3 years and annual progress reporting
- Achievement of the national target through energy obligation scheme
- Enhancing energy performance of the buildings through requirement of
  - Energy performance certificates
  - Installation of self-regulating devices
  - Building automation and control system
- Enforcement of the act for displaying energy labels of products

Figure 3-3 Energy efficiency requirements at the Member States level

*(*NEEAP: National Energy Efficiency Action Plan)*

(Source: European Commission directives)

As a contribution to the EU's 2030 target, the Member States must set their own targets in terms of absolute level of primary energy consumption and final energy consumption in 2030, with an indicative trajectory for that contribution from 2021 onwards *(European Commission, 2018i, Regulation (EU) 2018/1999, Article 4 (b), P.18).* Nonetheless, the Member States except Cyprus and Malta, must achieve the minimum target of annual savings of 0,8 % of absolute final energy consumption averaged over the most recent three-year period prior to 1 January 2019 for the entire obligation period 2021 to 2030 *(European Commission, 2018f, Directive (EU) 2018/2002,Article 7.1,P.8).* For monitoring and reporting purpose, the member countries must draw up National Energy Efficiency Action Plans (NEEAPs) every three years and annually report the progress of these plans to the EC, as mentioned under Section 2.1 *(Dutch Government, 2017).*

Energy obligation scheme

For achieving the national energy efficiency target, the Member States should adopt energy obligation scheme for allocation of the energy savings target to the designated obligated parties including energy distributors, retail energy sales companies and transport fuel distributors or retailers *(European Commission, 2018f,Directive (EU) 2018/2002,Point 14,P.3).* Under this scheme, the Member States shall have freedom to choose the obligated parties and shall express the contribution of each obligated party in terms of either primary or final energy consumption *(European Commission, 2018f, Directive (EU) 2018/2002, Article 7a (4), P.11).* Further, the energy savings should be additional to 'business as usual', and only net savings, which are directly attributable to specific energy efficiency measures, are accounted. As an alternative to energy savings, the obligated parties may transfer amount to an Energy Efficiency National Fund for funding energy efficiency measures *(European Commission, 2018f, Directive (EU) 2018/2002,Point.17,P.3).*However, setting up of an Energy Efficiency National Fund is not mandatory for the Member States and its design (if any) shall be determined by the Member States individually through their national regulations.

Additionally, the Member States shall also carry out independent documented verification of at least a statistically significant proportion and representative sample of the energy efficiency improvement measures implemented by the obligated parties *(European Commission, 2018f, Directive (EU) 2018/2002,Article 7a(5), P.11).* The energy savings achievement of each obligated party, or each sub-category of obligated party, and in total under the scheme shall also be published annually.

Energy performance of buildings

The Member States should also ensure that the rental properties achieve a certain level of energy performance in accordance with the energy performance certificates *(European Commission, 2018h, Directive (EU) 2018/844, Point.9, P.2).* The desired level of energy performance should be determined by each Member State through their national regulations. The energy performance may be assessed based on the indicators such as total, non-renewable and

renewable primary energy use, greenhouse gas emission produced in kg CO_2 eq/ (m^2 .y), and additional numeric indicators as determined by the Member States *(European Commission, 2018h, Directive (EU) 2018/844,Annex (1)- (c),P.16).* The energy performance of a technical building system should be assessed during installation, replacement, and upgradation, and for issuing of a new energy performance certificate *(European Commission, 2018h, Directive (EU) 2018/844, Article 8.9, P.10).* Besides, an annual independent audit should also be conducted by the competent national authorities for verification of a statistically representative sample of the energy performance certificates *(European Commission, 2018h, Directive (EU) 2018/844, Annex II (a), P.17).* The details of the audit including the responsible authority, duration and procedure should be determined by each Member State through their national regulations.

Moreover, all the new buildings should be equipped with self- regulating devices for the separate regulation of the temperature in each room or, in a designated heated zone of the building unit wherever technically and economically feasible *(European Commission, 2018h, Directive (EU) 2018/844, Article 8.1, P.9).* The period to be considered for defining new buildings is not stipulated by the EU and may be determined by the Member States. While in the case of existing buildings, self-regulating devices should be installed when the heat generators are replaced, if technically and economically feasible. The non- residential buildings with an effective rated output of over 290 kW for combined space heating and ventilation systems as well as for combined air- conditioning and ventilation systems should be equipped with building automation and control systems by 2025 wherever technically and economically feasible *(European Commission, 2018h, Directive (EU) 2018/844, Article 14.4, P.12; Article 15.4, P.13).*

Energy labels for the products

The Member States should enforce the relevant delegated act for displaying the energy labels on the packaging of the products, in accordance with the EU energy labelling scheme as discussed earlier *(European Commission, 2017b, Regulation (EU) 2017/1369, Point.12, P.3).* The relevant delegated act should be enforced through the national regulations of the Member States.

3.2 DUTCH NATIONAL LEVEL (THE NETHERLANDS)

In order to fulfil the obligations regarding energy and climate change, the Netherlands has adopted national level regulatory framework as described under Section 2.2. In this respect, the key requirements regarding energy efficiency at the Dutch National level by 2030 are represented in *Figure 3-4*. These requirements are mainly governed by the following plans.

- Dutch national Climate agreement dated 28 June 2019
- Draft integrated national energy and climate plan of the Netherlands (2021-2030) dated 6 November 2018
- National energy efficiency action plan (2017)

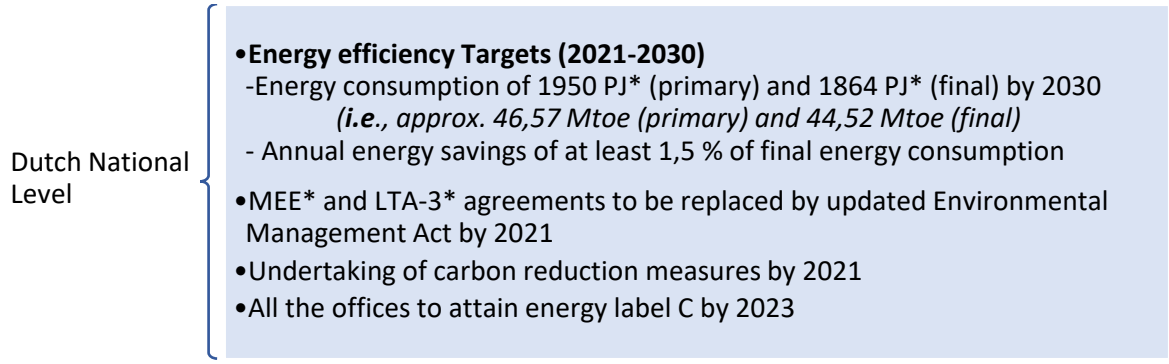


Figure 3-4 Energy efficiency requirements at the Dutch national level

*(*PJ: Peta Joules; MEE- Long-Term Agreement for the Energy Efficiency; LTA-3: Long-Term Agreement 3)*

*(**Source**: Various national level agreements and plans)*

As a contribution to the EU level target of 32,5% reduction in the energy consumption, the Netherlands aims to achieve a maximum of 1950 petajoules (PJ) in terms of primary energy consumption and 1864 PJ of final energy consumption at the country level by 2030 *(Dutch Government, 2018a, draft NECP, Section 1.1 iii), P.8, Para.4).* Moreover, it aims to attain annual energy savings of at least 1,5 % of final energy consumption during the period 2021-2030 *(Dutch Government, 2017, NEEAP, Section 3.1.1, P.9, Para.3).s*

In accordance with the energy obligation scheme as mentioned under Section 3.1, the energy efficiency targets are allocated to the obligated parties including the manufacturing companies up to year 2020. The present energy efficiency obligations for the manufacturing companies can be listed as follows *(Rijksoverheid, 2019).*

i. **Energy saving obligation** under the Environmental Management Act (Wm)
ii. **Obligation to provide information on the EE measures** implemented pursuant to the Environmental Management Act (Wm)
iii. **Energy audit obligation** based on the European Energy Efficiency Directive (EED)
iv. **Energy label obligation** for the building (s) according to the European Energy Performance of Buildings Directive (EPBD)

In case of large and energy intensive companies, the first three requirements are fulfilled through the Long-Term Agreement for the Energy Efficiency (MEE) for ETS enterprises and Long-Term Agreement 3 (LTA 3) for non-ETS companies *(Dutch Government, 2017).* Under these agreements, the companies are allocated an energy savings target for a 4 years period. They must draw up an energy efficiency plan (EEP) for the period to achieve the target and report annually on the measures implemented as per EEP. As per the current status, all the participating companies have submitted EEPs for the 2017-2020 period *(Dutch Government, 2017).* For the companies not participating in LTA3 or MEE, it is mandatory to comply with all the four above listed requirements separately.

From 1-1-2021, the MEE and LTA3 covenants shall cease to exist, and shall be replaced by amended Environmental Management Act *(Dutch Government, 2019, Climate agreement, Section C3.2.2, P.85, Point.29).* As per the updated Environmental Management Act, it shall be mandatory for all the companies to undertake CO_2 reduction measures having payback period of 5 years or less *(Dutch Government, 2019, Climate agreement, Section-C3.3.4, P.93).* It is stated that both energy-saving measures and sustainable energy generation measures can be implemented as CO_2 reduction measures. The specific energy efficiency obligations under this Act are not clear at this stage *(Interview-with-RVO-official, 2019).* It is gathered that the eligible CO_2 reduction measures and targets shall be communicated through the guidelines of amended Environmental Management Act. As mentioned under Section 2.2, the amendment shall be drawn in close consultation with industry and small and medium enterprises (SMEs) and will be submitted to the Lower House (*Tweede Kamer*) before 1 July 2020 *(Dutch Government, 2019, Climate agreement, Cl- C3.3.4,P.93).*

Therefore, the energy saving target for ETS companies is uncertain post 2020. However, the energy audit obligation shall remain applicable for the large companies after 2020 except for the companies having a valid ISO 50.001, 40.001, 40.051 certificate or a valid management system (*Rijksoverheid*, 2019). Moreover, the energy label obligation shall continue to be fulfilled through issue of an energy label for the building via a certified energy consultant, which demonstrates the energy-efficiency of the building *(Rijksoverheid, 2019).* In this respect, all the offices shall be required to attain energy label C by 2023 which indicates the energy-saving of the building *(Dutch Government, 2017, NEEAP, Section 3.2.1,P.21,Para.3).* It is stated that a regulation in this respect shall be enforced by 1 January 2023.

3.3 HUHTAMAKI FIBER PACKAGING

<CONFIDENTIAL>

To summarize, the findings of this Chapter provide answer to the 2nd Research Question which deals with energy efficiency requirements at the EU level and their reflection on the Member state level such as the Netherlands and implications on Huhtamaki for the period 2021-2030. The summary of the key findings is represented in *Figure 3-5.*

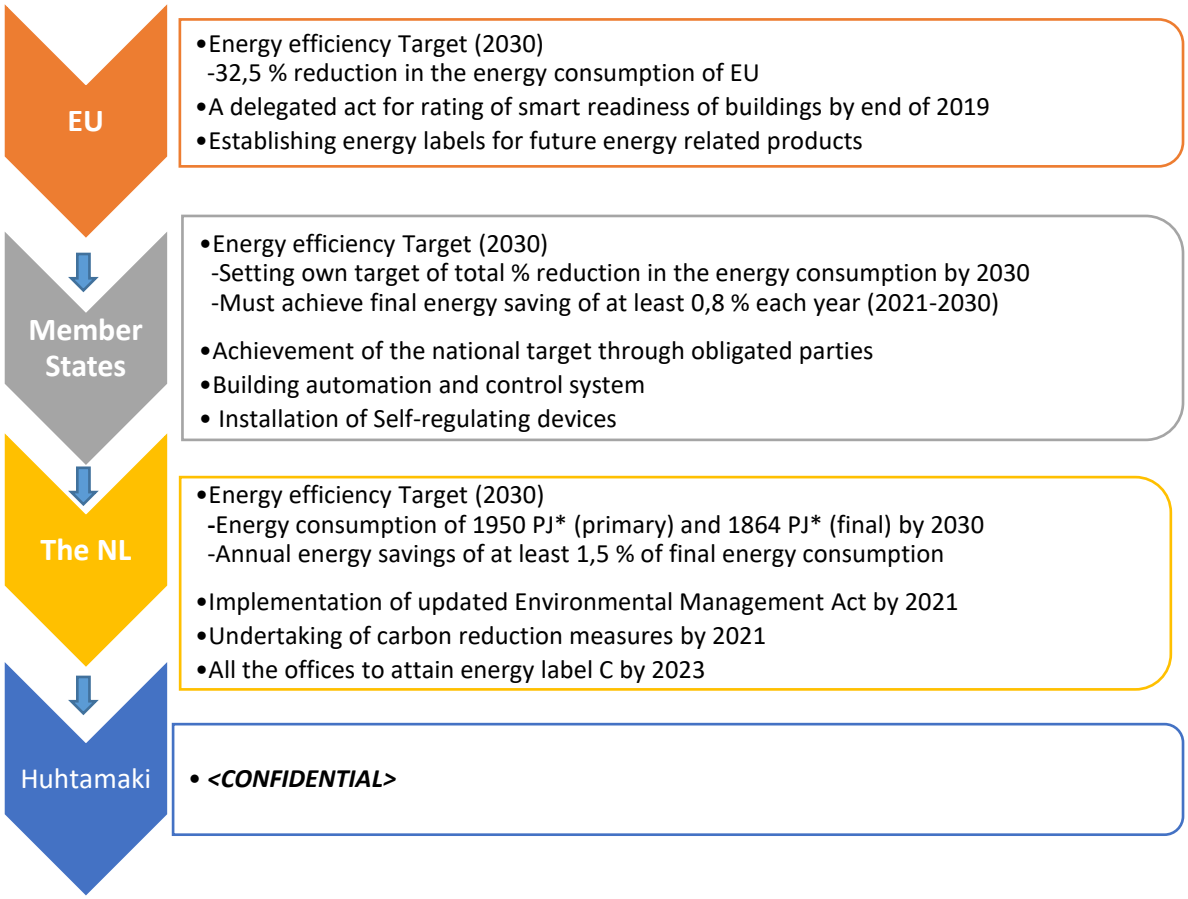


Figure 3-5 Energy efficiency requirements summary

*(*PJ: Petajoules, NECP: Integrated national energy and climate plan, NEEAP: National energy efficiency action plan)*

To this end, it is observed that the key obligation of the EU is achievement of their energy efficiency target, which drives other requirements such as enhancing energy performance of the buildings and the energy-related products, and promotion of best fossil fuel technologies in addition to renewable energy. These EU level obligations are reflected at the Member States level primarily in terms of their energy efficiency target, and requirement of preparing integrated national energy and climate plan (NECP) and national energy efficiency action plan (NEEAP) for monitoring and reporting of their targets and achievements.

In order to achieve the target, the Member States are required to undertake energy obligation scheme for allocation of their target to the obligated parties. Besides, the Member States should promote energy performance of the buildings and energy-related products by taking up measures such as energy performance certificates, installation of self-regulating devices, installation of building automation and control system and energy labels. The requirements

at the Member States level are fulfilled by the Member states through their national regulations.

The Netherlands has adopted national level regulatory framework under which the requirements such as national energy efficiency target and measures to achieve this target are defined. The energy efficiency target is currently allocated to the ETS companies up to the year 2020 under MEE covenant, which shall be replaced by amended Environmental Management Act by 2021. Under this amended act, it shall be mandatory for these companies to undertake carbon reduction measures including energy saving measures having payback period of 5 or less years. However, the actual energy saving obligations for ETS companies from 2021 shall become clear only after publication of the guidelines of “amended Environmental Management Act” likely by July 2020. Other important requirements include energy label obligation for the buildings and energy audit obligation. In this respect, all the offices must attain energy label C by 2023, and energy audit obligation may be fulfilled through energy management systems.

4 FUTURE (ANTICIPATED) REQUIREMENTS REGARDING RENEWABLE ENERGY BY 2030

This Chapter describes the future requirements regarding renewable energy for the period 2021-2030 at the level of European Union (EU) and their reflection on the Member States (under section 4.1) and Dutch National level (under Section 4.2). The implications of these requirements on Huhtamaki are analyzed under Section 4.3. Notably, this chapter covers those regulations which bear relevance with the manufacturing companies.

4.1 EU LEVEL AND THEIR REFLECTION ON THE MEMBER STATES

The key requirements regarding renewable energy for the period 2021-2030 are firstly assessed at the EU level which is the topmost level. The assessment is carried out with reference to the regulatory framework described in Section 2.1. The key requirements are indicated in *Figure 4-1* and are mainly governed by the following EU directives.

i. Governance of the Energy Union and Climate Action Regulation *(Regulation (EU) 2018/1999)*

ii. Renewable Energy Directive *(Directive (EU) 2018/2001)*

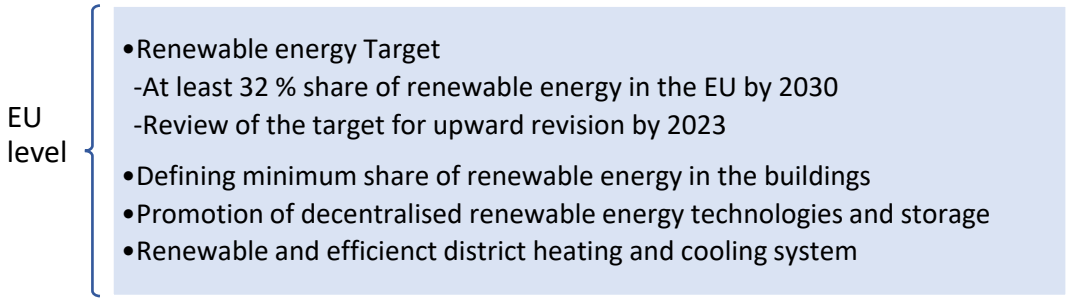


Figure 4-1 Renewable energy requirements at EU level

*(**Source**: European Commission directives)*

As the central requirement, the EU must achieve the target of at least 32 % share of renewable energy by 2030 *(European Commission, 2018e, Directive (EU) 2018/2001, Point 8, P.2).* Notably, this target shall be considered for increase by the European Commission (EC) during 2023 in case of substantial cost reductions, or a significant decrease in energy consumption in the Union or the need to meet the Union's international commitments for decarbonization.

To achieve this target, the EU should promote defining of minimum share of renewable energy sources in new and renovated buildings through building regulations and codes *(European Commission, 2018e, Directive (EU) 2018/2001, Point.47, P.7)*. Furthermore, the development of decentralized renewable energy technologies and storage should be promoted *(European Commission, 2018e, Directive (EU) 2018/2001, Point.71,P.11)*. Besides, the district heating and cooling system across the Union should be decarbonized through renewable energy deployment and increased energy efficiency *(European Commission, 2018e, Directive (EU) 2018/2001, Point.75,P.12).* Non-efficient district heating and cooling systems should be phased out by allowing the consumers

to disconnect from such systems and produce their heating or cooling from renewable and energy efficient sources (European Commission, 2018e, *Directive (EU) 2018/2001, Point.79, P.12*).

REFLECTION ON THE MEMBER STATES

The requirements at the level EU are reflected as certain obligations for the Member States which are represented in *Figure 4-2*. However, it is important to note that most of these requirements are guiding in nature and should be fulfilled by the Member States through their national regulations.

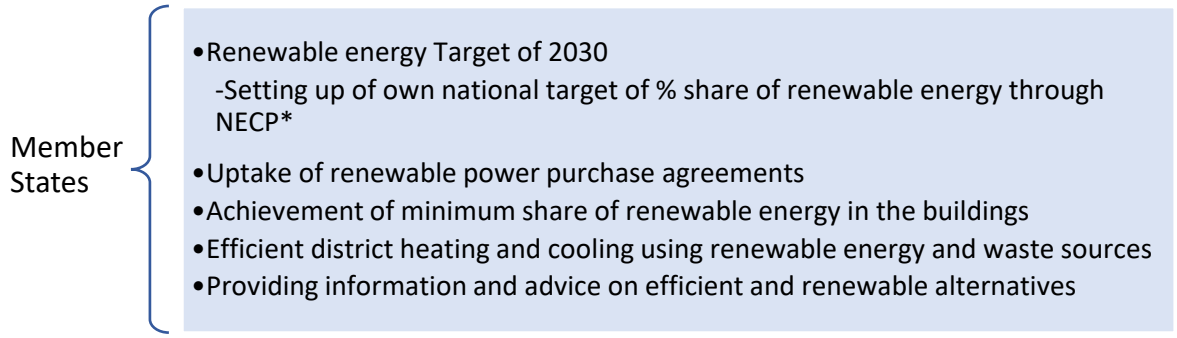


Figure 4-2 Renewable energy requirements at the member states level

*(*NECP: Integrated national energy and climate plans)*

***(Source**: European Commission directives)*

As a contribution to the EU's 2030 target, the Member States should set their national renewable energy target for 2030 under their NECPs along with the indicative achievement of their target at intermediate reference years of 2022, 2025 and 2027 *(European Commission, 2018i, Regulation (EU) 2018/1999, Article 4.a.2, P.18).* The achievement of the 2030 target is measured as the percentage increase between the Member State's binding 2020 national target or achievement (whichever is higher) and its 2030 target. This percentage increase should be at least 18% (by 2022), 43% (by 2025), 65% (by 2027) and 100% (by 2030). However, the Member states are free to set higher interim targets for national policy purposes. The Commission shall assess the achievement of these 'reference points' in 2022, 2025 and 2027 on the basis, a, of the Member States' integrated national energy and climate progress reports *(European Commission, 2018i, Regulation (EU) 2018/1999, Point.59, P.10).* In this respect, the Member States which lag their reference points shall provide their plan in their next progress report for covering the gap and undertake additional measures to meet their target.

For the achievement of the target, the Member States shall facilitate the uptake of renewable power purchase agreements by describing requisite policies and measures in their NECPs *(European Commission, 2018e, Directive (EU) 2018/2001, Article 15.8, P.34).* Moreover, the Member States shall establish the requirement of a certain minimum share of renewable energy including waste heat and cold in new and existing buildings through building regulations and codes or by other means with equivalent effect (European Commission, 2018e, *Directive (EU) 2018/2001, Article 15.4, P.33*). This minimum share of renewable energy should be determined by each Member State through their national regulations.

Additionally, the Member States shall promote the replacement of old heating systems with more energy-efficient and renewable alternatives *(European Commission, 2018e, Directive (EU) 2018/2001, Article 15.6, P.34).* In this direction, the Member States should provide adequate information and advice on such alternatives as well as eventual financial instruments and available incentives for replacement.

4.2 DUTCH NATIONAL LEVEL (THE NETHERLANDS)

In order to fulfil the obligations regarding energy and climate change, the Netherlands has adopted the national-level regulatory framework as described under Section 2.2. In this respect, the key requirements regarding renewable energy at the Dutch National level by 2030 are represented in *Figure 4-3.* These requirements are mainly governed by the following plans.

- Dutch National Climate agreement dated 28 June 2019
- Draft Integrated national energy and climate plan (2018)
- Energy Agenda (2016)

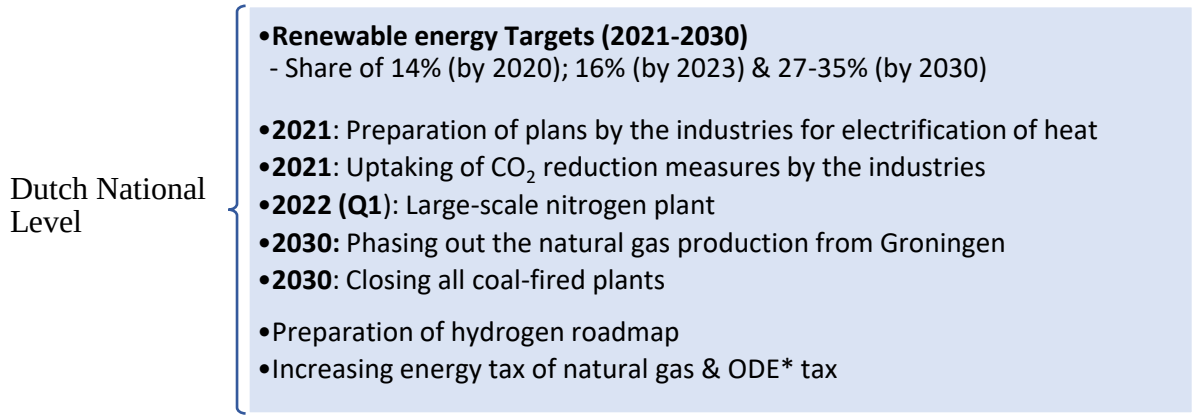


Figure 4-3 Renewable energy requirements at the Dutch national level

*(*ODE: Sustainable energy storage)*

*(**Source**: Various national level agreements and plans)*

The Netherlands aims to achieve a share of renewable energy of 14% in 2020 which will increase to 16% in 2023 and 27-35% by 2030 *((RVO, 2014, Energy Agreement, P.5); (Dutch Government, 2018a, draft NECP, Section 1.1.iii, P.8, para.3)).* For achievement of these targets, several measures shall be undertaken with the most important being decrease in production of natural gas from the Groningen field and fully phasing out by 2030, closing all coal-fired plants by 2030, continuing the large-scale rollout of offshore wind energy after 2023 and preparation of hydrogen roadmap *((Dutch Government, 2018a, draft NECP, Section 4.4.1,P.89; Section 1.2.i, P.9)).*

With reference to natural gas, the government aims to reduce its use while at the same time ensure the reliability of energy supply through several backup measures. In this direction, reduced extraction of natural gas from Groningen having an average low-calorific value shall

be compensated by importing natural gas having an average high-calorific value (*Dutch Government, 2018a, draft NECP, Section-3.4.2 i, P.49, Para.3)*). Besides, a new, large-scale nitrogen plant shall be constructed in the first quarter of 2022 for converting 5 to 7 billion m3 of natural gas from an average high calorific value to an average low-calorific value each year suited to existing infrastructure. Further, the extraction of natural gas from small fields in the North Sea shall be boosted (*Dutch Government, 2018a, draft NECP, Section-3.3 i, P.46, Para.1).* Notably, the Government is also reviewing and reconsidering the requirement under which all the industrial Groningen-gas users should switch to natural gas of a high calorific value or to other sustainable sources of energy by the year 2022[9] *(Dutch Government, 2018b, Dutch Cabinet: Termination of natural gas extraction in Groningen, News Item, Para 7); (Interview-with-RVO-official, 2019).*

In the context of offshore wind power, the installed capacity of offshore wind energy shall be 4.5 GW by 2023 and will be further expanded at a rate of 1 GW per year between 2024 and 2030, resulting in roughly 11.5 GW by 2030 *(Dutch Government, 2018a, draft NECP, Section-3.1.2 i, P.39, Para.2).* In order to realize this ambition, new offshore areas will also be designated as future zones for offshore wind energy. Additionally, a Hydrogen Roadmap has been drawn up for further roll-out of hydrogen for mobility, energy production, transport and storage, and for the provision of raw materials in the industry *(Dutch Government, 2018a, draft NECP, Section iii, P.16, Para.1).* A substantial hydrogen program will also be taken up for opening up of the supply of green hydrogen, developing the necessary infrastructure and cooperation with various sector programs, and facilitating current initiatives and projects *(Dutch Government, 2019, Climate agreement, Section C5.7, P.171, Para.1).*

Energy Taxes

The Government also aims to promote the consumption of renewable energy and discourage the consumption of natural gas. Therefore, it is proposed to increase the energy tax rate of the first natural gas tranche by 4 cents per m3 in 2020 and 1 cent per m3 annually in the next six years until 2026, while decreasing the tax rate for electricity consumption *(Dutch Government, 2019, Climate agreement, Section C1.6,P.23, Para.2).* However, it is stated that the intended increase in the energy tax on natural gas shall be reviewed in 2023 considering the autonomous development of market prices. The cabinet shall also increase the share of sustainable energy storage (ODE) tax for the industries from 1/2 to 2/3 with respect to households starting from 2020 *(Dutch Government, 2019, climate agreement, Section C3.3.8, P.104, Para.2).* The proposed decrease in the energy tax rate for electricity and an increase in sustainable energy storage (ODE) tax is not available as on date *(Interview-with-RVO-official, 2019).*

[9] https://www.government.nl/latest/news/2018/03/29/dutch-cabinet-termination-of-natural-gas-extraction-in-groningen

Obligations of industries

In light of the national-level measures for increasing the share of renewable energy, the government expects the businesses to invest in sustainable forms of energy such as solar, geothermal, biogas, hydrogen, residual heat, etc., efficient heat use and electrification of heat *(Dutch Government, 2016a, Energy Agenda, Section-4.3.2, P.57, Para.1).* Notably, detailed plans are drawn under the Climate agreement to supply residual heat from the industry for heating houses and buildings and to supply CO_2 to horticultural greenhouses *(Dutch Government, 2019, Climate agreement, Section C3.2.2, P.86, Para.3).* There are also plans for large-scale production of green hydrogen in various industrial clusters. Besides, the Climate agreement states that the companies are expected to finalize their CO_2 reduction plans by 2021 including plans for electrification of heat *(Dutch Government, 2019, Climate agreement, Section C5.2, P.157, Para.2).* Based on these plans, a joint decision shall be taken up in 2021 on the possible scaling up of renewable electricity in connection with additional electricity demand. However, it is not a mandatory requirement and further, there is a lack of clarity about the guidelines and timelines for the same at this stage (*Interview-with-Secretary-VNP, 2019*).

Additionally, as mentioned under Section 3.2, the companies shall be required to undertake CO_2 reduction measures having a payback period of 5 or fewer years from 1 January 2021 under amended Environmental Management Act (*Dutch Government, 2019, Climate agreement, Section-C3.3.4, P.93, Para.1).* To reduce CO_2 emissions, the industry may adopt measures such as process efficiency, energy-saving, electrification, use of blue and green hydrogen, carbon capture and storage (CCS), the circularity of products, etc. *(Dutch Government, 2019, Climate Agreement, Section-C3.2.2, P.84, Para.2).* The specific renewable energy obligations under this Act are not clear at this stage and shall be clarified after the guidelines of the amended Environmental Management Act are published *(Interview-with-RVO-official, 2019).* As mentioned under Section 2.2, the amendment shall be drawn in close consultation with industry and small and medium enterprises (SMEs) and will be submitted to the Lower House (*Tweede Kamer*) before 1 July 2020 *(Dutch Government, 2019, Climate agreement, Section- C3.3.4, P.93).*

In view of forthgoing, it may be observed that there are no specific mandatory requirements for the industries regarding renewable energy measures, while they are recommended to achieve CO_2 reduction. Since the focus of the Dutch Government is centred around the goal of reducing CO_2 emissions, it is anticipated that flexibility shall be provided to the companies in setting renewable energy and energy efficiency targets to achieve the same *(Interview-with-Secretary-VNP, 2019).*

4.3 HUHTAMAKI FIBER PACKAGING

<CONFIDENTIAL>

To summarize, the findings of this Chapter provide the answer to the 3rd Research Question which deals with the renewable energy requirements at the EU level and their reflection on the Member state level such as the Netherlands and implications on Huhtamaki for the period 2021-2030. The summary of the key findings is represented in *Figure 4-4.*

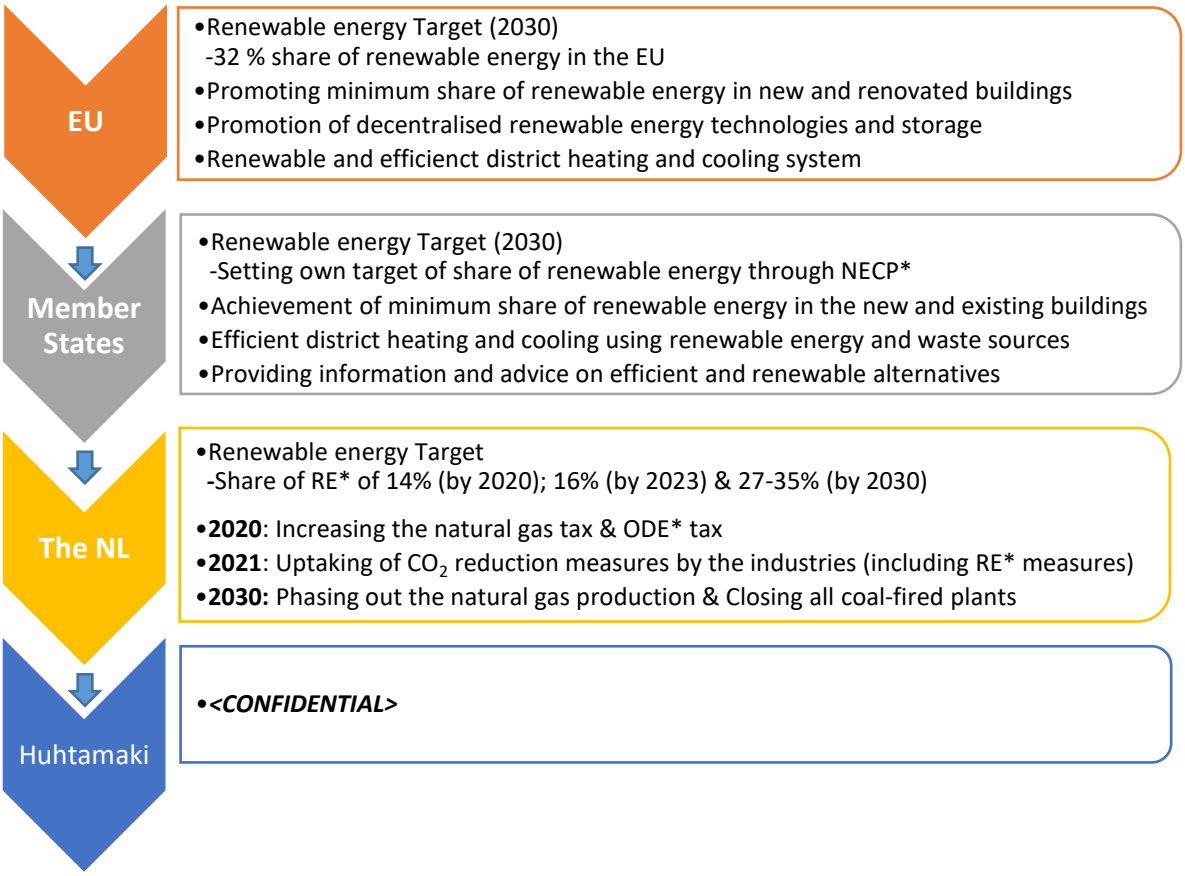


Figure 4-4 Renewable energy requirements summary

*(*NECP: Integrated national energy and climate plan, ODE: Sustainable energy storage)*

To this end, it is observed that the key obligation of the EU is the achievement of their renewable energy target, which drives other requirements such as defining the minimum share of renewable energy in the buildings, promotion of decentralized renewable energy, and renewable and efficient district heating and cooling systems. These EU level obligations are reflected at the Member States level primarily in terms of their renewable energy target for 2030. In order to achieve the target, the Member States should promote renewable power purchase agreements, minimum share of renewable energy in the buildings, efficient district heating and cooling system, and replacement of old heating systems with renewable and energy-efficient alternatives. Moreover, they should also provide adequate information and advice on such alternatives and available incentives. The requirements at the Member States level are fulfilled by the Member states through their national regulations.

The Netherlands has adopted a national-level regulatory framework under which the requirements such as national renewable energy targets and measures to achieve this target are defined. The important requirements pertain with the aspects such as phasing out the natural gas production from Groningen by 2030, closing all coal-fired plants by 2030, the large-scale rollout of offshore wind energy, preparation of hydrogen roadmap and increase in the energy tax. Besides, several backup measures shall be taken up to compensate reduced extraction of natural gas such as importing natural gas, setting up of a large-scale nitrogen plant and extraction of natural gas from small fields in the North Sea. However, other requirements at the Member States level such as defining the minimum share of renewable energy, decentralised renewable energy and efficient district heating, and cooling system are not reflected in the Dutch national regulations as on date and may be expected to be enforced in the future.

5 FUTURE (ANTICIPATED) REQUIREMENTS REGARDING GHG EMISSIONS BY 2030

This Chapter describes the future requirements regarding GHG emissions for the period 2021-2030 at the level of European Union (EU) and their reflection on the Member States (under section 5.1) and Dutch National level (under section 5.2). These requirements stem from the regulatory framework discussed in Chapter 2. The implications of these requirements on Huhtamaki are analyzed under section 5.3. Notably, as mentioned under the scope of research, this chapter covers those regulations which bear relevance with the manufacturing companies under the EU Emission Trading System (EU ETS). Further, it mainly focuses upon the aspect of allocation of the free emission allowance.

5.1 EU LEVEL AND THEIR REFLECTION ON THE MEMBER STATES

The key requirements regarding GHG emissions for the period 2021-2030 are firstly assessed at the EU level which is the topmost level. The assessment is carried out with reference to the regulatory framework described under *Section 2.1*. The key requirements are indicated in *Figure 5-1* and are mainly governed by the following EU directives.

i. Governance of the Energy Union and Climate Action Regulation *(Regulation (EU) 2018/1999)*
ii. Revised EU ETS Directive *(Directive (EU) 2018/410)*
iii. Monitoring and Reporting of GHG Emissions *(Directive (EU) 2018/2066)*
iv. Free emission allocation Decision *(Directive (EU) 2019/331)*
v. Carbon leakage Decision *(Directive (EU) 2017/708)*

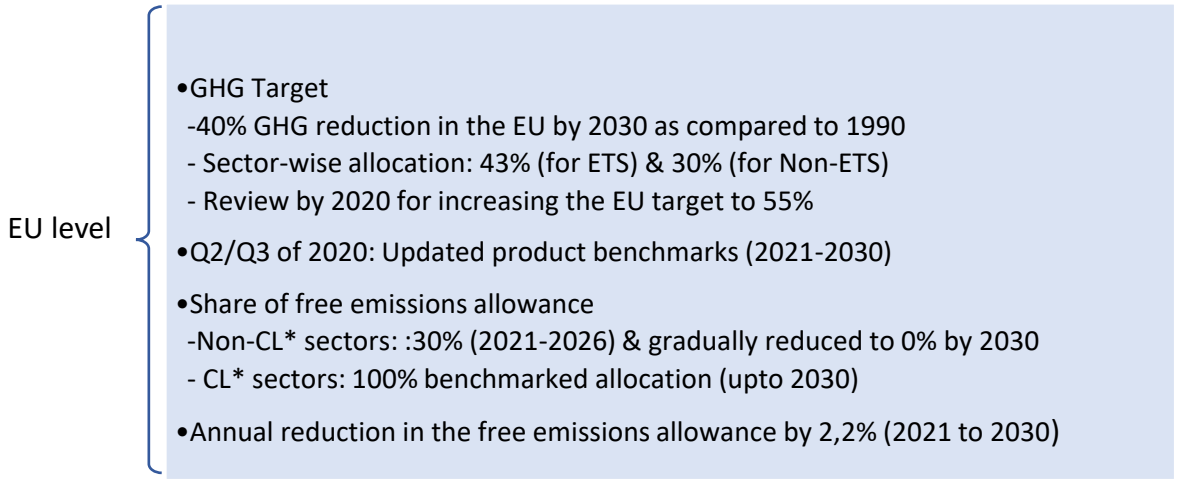


Figure 5-1 GHG emissions requirements at the EU level

*(*CL: Carbon leakage)*

***(Source**: European Commission directives)*

As the central requirement, the EU must achieve 40 % reduction in the GHG emissions by 2030 as compared to 1990 *(European Commission, 2018a).* This translates as a target of 43% for EU-ETS sectors and 30% for non-ETS sectors for reduction in GHG emissions by 2030 as compared to 2005. Notably, the EC shall review increasing the EU level target from 40% to

55% by 2020 based the proposal put forward by the Dutch cabinet *(Dutch Government, 2019, Climate Agreement, P.4, Para 2).*

In order to achieve the target of the ETS sectors, the ETS companies shall be allocated only a certain share of emission allowances as free allowances while the remaining allowances shall be required to be purchased through auctioning. The brief functioning of EU ETS is described under *Annexure 1*. In this respect, it is important to note that the allocation of free emission allowances for ETS companies is determined based on the relevant benchmark value[10], carbon leakage[11] (CL) classification and the production levels *(European Commission, 2013)*. The EC aims to achieve a more focused allocation of free allowances by updating the benchmarks aligned with the technological progress and updating CL classification *(European Commission, 2013).* The sectors at genuine risk of CL shall be determined and differentiated based on their trade intensity and their emissions intensity *(European Commission, 2018g, Directive (EU) 2018/410, Point 10, P.3).* The fluctuation in the production levels is also accounted by periodically adjusting the free allocation in a symmetrical manner and the relevant acceptable threshold for changes in the production levels is set at 15 %, calculated on the basis of a rolling average of two years *(European Commission, 2018g, Directive (EU) 2018/410, Point 12, P.4).*

It is noteworthy that the CL list applicable for the period 2021-2030 (EU ETS phase 4) was adopted by EU on 15 February 2019 *(European Commission, 2019a, Directive (EU) 2019/708, Article 1-Annex, P.5).* This list indicates the sectors and subsectors deemed at the risk of CL using NACE codes[12] and PRODCOM codes[13]. Furthermore, the European benchmark is updated every five years, next updates shall be published in 2020 for the period 2021-2025 and in 2025 for the period 2026-2030 *(Dutch Government, 2019, Climate Agreement, Section C3.3.1,P.89, Para1).* In this regard, the EC released preliminary product benchmark values for the trading period (2021-2025) in 2019 *(European Commission, 2019b, Directive (EU) 2019/331, Point 4, P.1, Para.1).*These benchmark values are being further reviewed for the appropriate reduction factor and shall be finalized likely in Q2/Q3 of 2020 *(Interview-with-NEA-Official, 2019)*

As mentioned above, CL sectors are provided additional free emission allowances as compared to Non-CL sectors. For the trading period (2021-2030), CL sectors shall receive 100% free allowances with respect to the applicable benchmark, while for Non-CL sectors the annual reduction factor as mentioned under *Annexure 6* shall be applied for allocation of free emission allowance *(European Commission, 2019b, REGULATION (EU) 2019/331,Annex V, P.48).*

[10] The benchmark values refer to the average per unit GHG emissions of the 10% most efficient installations *(European Commission, 2019b).*

[11] Carbon leakage refers to the situation when stringent climate policies reduce the competitiveness of the businesses leading to the transfer of production locations to other countries having laxer regulations on greenhouse gas emissions *(European Commission, 2013).*

[12] NACE codes are 4-digit codes used to classify specific sector to which an installation belongs to, based on the activities carried out *("Emissions-EUETS.com," n.d.)*

[13] The PRODCOM code is an 8-digit code which defines the products of the European Community Inquiry *("Emissions-EUETS.com," n.d.).*

Moreover, EC aims to reduce the total number of free emission allowances at an annual rate[14] of 1,74% for the trading period (2013-2020), and 2,2% for the period (2021-2030) *(European Commission, 2013).*

REFLECTION ON THE MEMBER STATES

The EU level directives for EU ETS sectors are directly applicable in the Member States and enforced through a national competent authority, while in respect of non-EU ETS sectors they should be enforced through national regulations *(Dutch Emissions Authority, 2019).* The key obligations for the Member States regarding GHG emissions by 2030 are illustrated in *Figure 5-2.*

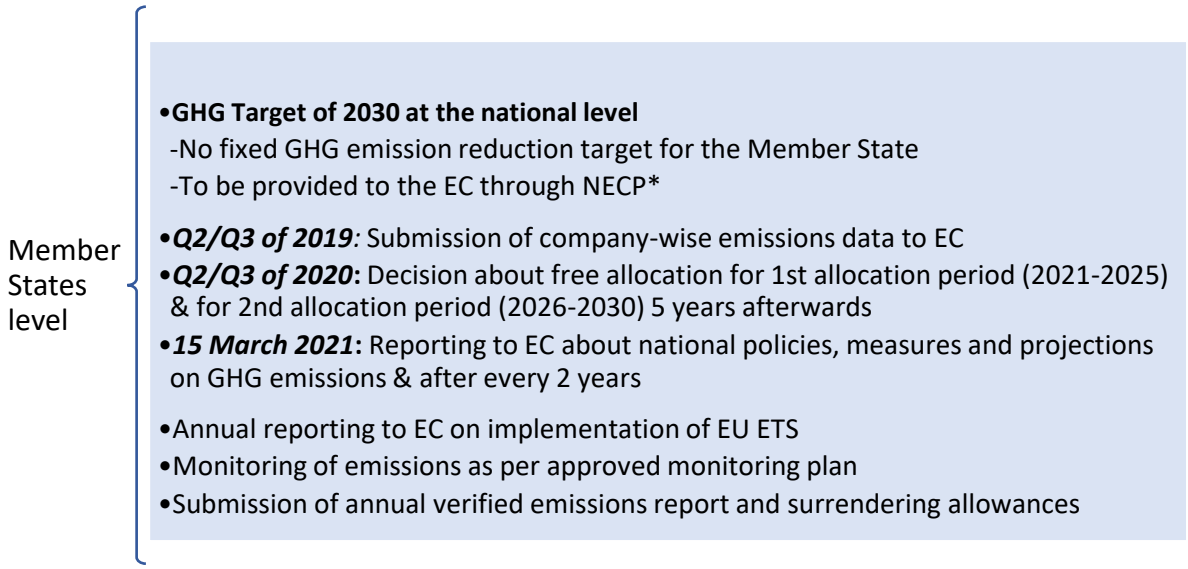


Figure 5-2 GHG emissions requirements at the Member States level

*(*NECP: Integrated national energy and climate plan)*

*(**Source**: European Commission directives)*

As a contribution to the EU's 2030 target, the Member States should provide their national GHG emission reduction target as well as the strategies in the integrated national energy and climate plans (NECPs) *(European Commission, 2017a).* Further, the EC shall ensure that the contributions of each Member State shall achieve the EU level target of 40% GHG reduction by 2030 as compared to 1990.

[14] Annual rate is also referred as the linear factor under Article 9 of EU directive 2018/410 dated 19.3.2018.

Application for free allocation shall be submitted by the ETS companies to the national competent authority for each allocation period[15] before 30 May 2019[16] as regards the first allocation period and every 5 years thereafter *(European Commission, 2019b, Regulation (EU) 2019/331, Article 4.1, P.7).* The Member States shall forward this company wise data to the EC in Q3/Q4 of 2019, based on which the final benchmarks for the 1st allocation period (2021-2025) shall be decided by the EC, expectedly in Q2/Q3 of 2020 *(Interview-with-NEA-Official, 2019)*. Thereafter, the Member States shall determine the free allocation for each ETS company during the 1st allocation period (2021-25) and 2nd allocation period (2026-2030) after 5 years, based upon the benchmark values set by the EC for each period *(Dutch Emissions Authority, 2019)*. However, the date by which the free allocation shall be determined by each Member State is not available, while the decision can be expected shortly after the benchmark values are finalized by the EC viz. Q3/Q4 of 2020 for the 1st allocation period *(Interview-with-NEA-Official, 2019)*.

Afterward, the Member States shall also submit to the Commission the final annual amount of emission allowances allocated free of charge for each year over the relevant allocation period *(European Commission, 2019b, Regulation (EU) 2019/331, Article 14.7, P.14)*. The methodology for calculating the final annual amount of emission allowances is provided at *Annexure 6*. The benchmark values and amount of free allocation per company shall generally remain constant for the trading period (2021-2025) and (2026-2030) *(Interview-with-Secretary-VNP, 2019).* However, it might be adjusted in case of shortfall in achieving the EU-wide target.

The Member States should report to the Commission on an annual basis about the implementation of the EU ETS Directive *(European Commission, 2013).* After allocation of free GHG emission allowances, the companies shall need to provide a conservative estimate of the annual average emissions at the beginning of each calendar year *(European Commission, 2018c, Regulation (EU) 2018/2066, Article 18.2, P.12).* In this respect, the companies need to ensure that the uncertainty in measurement should be less than the maximum permissible error in service allowed by the relevant national legislation. After submission of a conservative estimate, the companies need to monitor their greenhouse gas emissions during the year as per the monitoring plan approved by the national competent authority (European Commission, 2018c, *Regulation (EU) 2018/2066, Article 11.1, P.9*). At the end of the calendar year, they must submit their verified emissions report to the national competent authority, and surrender enough allowances to cover their total emissions for the calendar year *(European Commission, 2013)*. In the event that a company releases more emissions than the emissions permit, it has to buy

[15] Allocation period' means the five-year period starting from 1 January 2021 and each subsequent period of five years (European Commission, 2019b, *Regulation (EU) 2019/331*, *P.6*, *"Point 15"*, *Para 1*).

[16] Member States may set their own date for the submission of such applications, which, however, may not be later or earlier than one month compared to 30 May 2019 *(European Commission, 2019b, Regulation (EU) 2019/331, Article 4.1, P.7).*

allowances to make up the shortfall (European Commission, 2013). Further, if the excess emissions are not purchased, they must pay a fine for each excess tonne of greenhouse gas emitted.

Moreover, as mentioned under Section 2.1, the Member States should also report to EC by 15 March 2021, and every two years about their national policies and set of measures for reducing GHG emissions; and their national projections of anthropogenic greenhouse gas emissions by sources and removals by sinks *(European Commission, 2018i, Regulation (EU) 2018/1999,Article 18.1, P.26).*

5.2 DUTCH NATIONAL LEVEL (THE NETHERLANDS)

The EU level directives for EU ETS are implemented by *De Nederlandse Emissieautoriteit* (NEa) *(*- Dutch Emissions Authority) in the Netherlands. In addition to the EU level directives, the Dutch government has adopted the national-level regulatory framework for achieving the reduction in GHG emissions at the national level, as described under *Section 2.2*. In this respect, the key requirements regarding GHG emissions at the Dutch National level by 2030 are mentioned in *Figure 5-3*. The requirements are mainly governed by the following plans.

- Dutch national Climate agreement dated 28 June 2019
- Draft integrated national energy and climate plan dated 6 November 2018

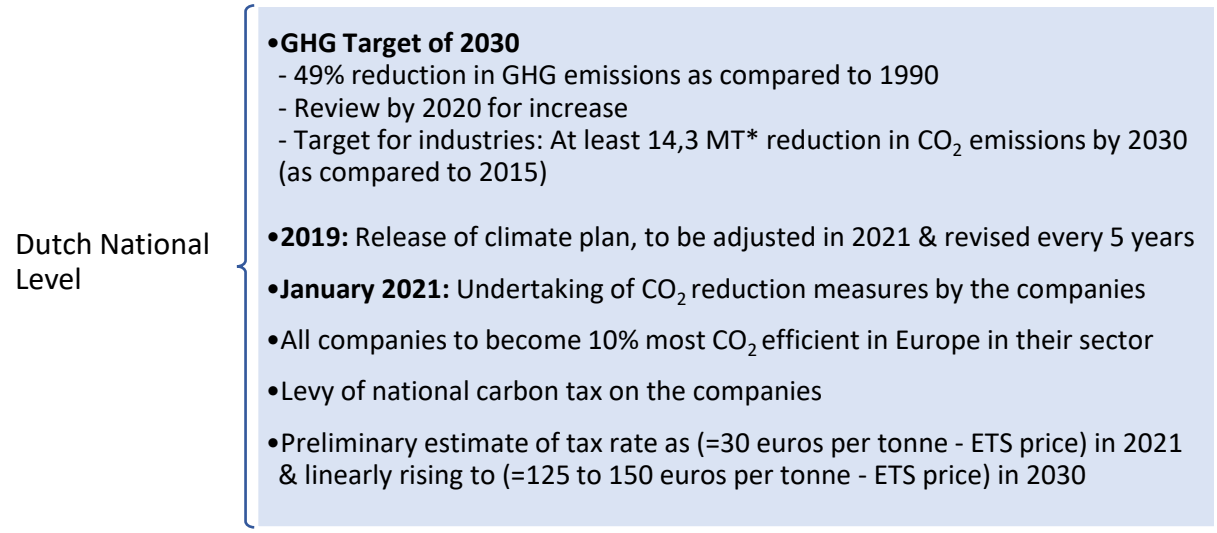


Figure 5-3 GHG requirements at the Dutch national level

*(*MT: Metric Tonne)*

*(**Source**: Various national level agreements and plans)*

The national Climate Agreement aims to achieve the central goal of reducing GHG emissions in the Netherlands in 2030 by 49% as compared to 1990 *(Dutch Government, 2019, Climate Agreement, Section A, P.4, Para 2*). Notably, the Dutch cabinet is also pursuing the EU for increasing the EU wide target from 40% to 55% in 2030 *(Dutch Government, 2019, Climate Agreement, Section A, P.4, Para 2).* Further, in case of increase in the EU wide target which shall be ascertained by EU in 2020, the final target of the Netherlands for 2030 may deviate from the 49% that the government now assumes. This would demand further stimulation of CO_2-reducing options

(production and demand), through intensifying technological development, standardization, pricing and subsidies *(Dutch Government, 2019, Climate Agreement, Section B2, P.7, Para 4).* In the long-term, by 2050, the Netherlands aims to reduce its GHG emissions by 95% with respect to the year 1990 and achieve 100% carbon neutral electricity production *(Dutch Government, 2018a, draft NECP, Section 1.2 ii, P.15, Para.4).*

Based on the climate agreement, a climate plan shall be formulated which would outline the government policies to be pursued for the period 2021-2030 *(Dutch Government, 2019, Section- B4, P.11, Para 2).* It further specifies that the first Climate Plan shall be released in 2019, which can be adjusted in 2021 and will be redefined at least once every five years.

The national-level target of 49% translates as an obligation for the industries to achieve at least 14.3 MT reduction in CO_2 emissions by 2030 and a further 5.1 MT through their additional statement as compared to the year 2015 *(Dutch Government, 2019, Climate Agreement, Section- C3.2.1, P.83, Para 2;* (Interview-with-Secretary-VNP, 2019)*).* This target only corresponds to direct and onsite emissions *(Interview-with-Secretary-VNP, 2019).* In order to achieve this target, all the Dutch companies must become 10% most CO_2 efficient companies in Europe in their sector *(Dutch Government, 2019, Climate Agreement, Section C3.3.7, P.102, Para.3).* In other words, all the Dutch companies should at least meet their applicable benchmark value as determined under ETS and approved by NEA *(Interview-with-Secretary-VNP, 2019).*

The Dutch government shall levy a national carbon tax upon the industries with respect to the excess emissions above their free allocation as determined under EU ETS *(Dutch Government, 2019, Climate Agreement, Section-C3.3.7, P.97, Para.1); (Interview-with-NEA-Official, 2019))*. NEa shall allocate the free emission allowances to the companies for the trading period (2021-25) shortly after the EU benchmarks are set, expectedly in Q3 or Q4 of 2020 *(Interview-with-NEA-Official, 2019).* Based on current insights, the national tax rate shall start in 2021 at 30 euros per tonne of excess CO_2 emitted (including ETS price) linearly rising to 125-150 euros per tonne (including ETS price) in 2030 *(Dutch Government, 2019, Climate Agreement, Section C3.3.7, P.99, Para.1).* The tax value at the intermediate years is difficult to determine at this stage *(Interview-with-NEA-Official, 2019)*.

The projected price path of the national carbon tax is represented in *Table 5-1.*

Table 5-1 Projected price path of national carbon tax (2021-2030)

Year	National Tax rate (including EU ETS price) (=1)	Expected EU ETS price (=2)	Applicable National Tax Rate [= (1)-(2)]
2021	€ 30	€20,5	€9,5
2022	Shall increase linearly, but year-wise estimates not available	€21	Projected to increase linearly, but year wise estimates not available
2023		€21,5	
2024		€24,6	
2025		€27,7	
2026		€30,8	
2027		€33,4	
2028		€36,3	
2029		€42,7	
2030	€125 to €150	€46,3	€75 to €100

*(*The prices are mentioned in Euro/tonne of CO_2 equivalent emissions.)*

*(**Source**: Dutch Government, 2019, Climate Agreement, Section C5.8, P.176)*

It can be seen from the above table that 'applicable national carbon tax' is equal to the difference between 'national carbon tax rate' and EU ETS price. Furthermore, the above-indicated prices are only based on the current estimate and the actual yearly national carbon tax rate shall likely vary. The actual starting point and the yearly rate of national carbon tax rate for the period 2021-2030 shall be firmed up by the Cabinet in 2020 and 2025 upon advice by PBL, based on the EU level ETS benchmarks *(Dutch Government, 2019, Climate Agreement, C3.3.7, P.98, Para.1).* However, the national carbon tax can be adjusted upwards in case of shortfall in achieving the national industry target *(Interview-with-Secretary-VNP, 2019).*

Notably, the CL companies shall be treated in the same manner as with EU ETS in terms of allocation of free emission allowances *(Interview-with-NEA-Official, 2019).* Furthermore, the companies may make use of transfer option for transferring the excess emissions to another company at cluster / regional level in order to reduce CO_2 in a cost-efficient way *(Dutch Government, 2019, Climate Agreement, Section-C3.3.7, P.102, Para.6).* However, this exchange shall be possible only within a year, and not between years. Besides, the further details of this transfer option are not yet available at this stage *(Interview-with-NEA-Official, 2019).*

In addition to the payment of national carbon tax, it shall be mandatory for all the companies to undertake CO_2 reduction measures having a payback period of 5 years or less from 1-1-2021, as analyzed under section 3.2 and section 4.2 *(Dutch Government, 2019, Climate Agreement, Section-C3.3.4, P.93, Para.1).* To reduce CO_2 emissions, the industry may adopt measures such as process efficiency, energy-saving, electrification, use of blue and green hydrogen, carbon capture and storage, the circularity of products, etc. *(Dutch Government, 2019, Climate Agreement, Section-C3.2.2, P.84, Para.2).* The climate agreement further stipulates that the captured CO_2 may be

reused as a nutrient in greenhouse horticulture *(Dutch Government, 2019, Climate Agreement, Section C3.2.2, P.86, Para.5).*

5.3 HUHTAMAKI FIBER PACKAGING

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To summarize, the findings of this Chapter provide answer to the 4th Research Question which deals with GHG emission requirements at the EU level and their reflection on the Member state level such as the Netherlands and implications on Huhtamaki for the period 2021-2030. The summary of the key findings is represented in the following *Figure 5-4.*

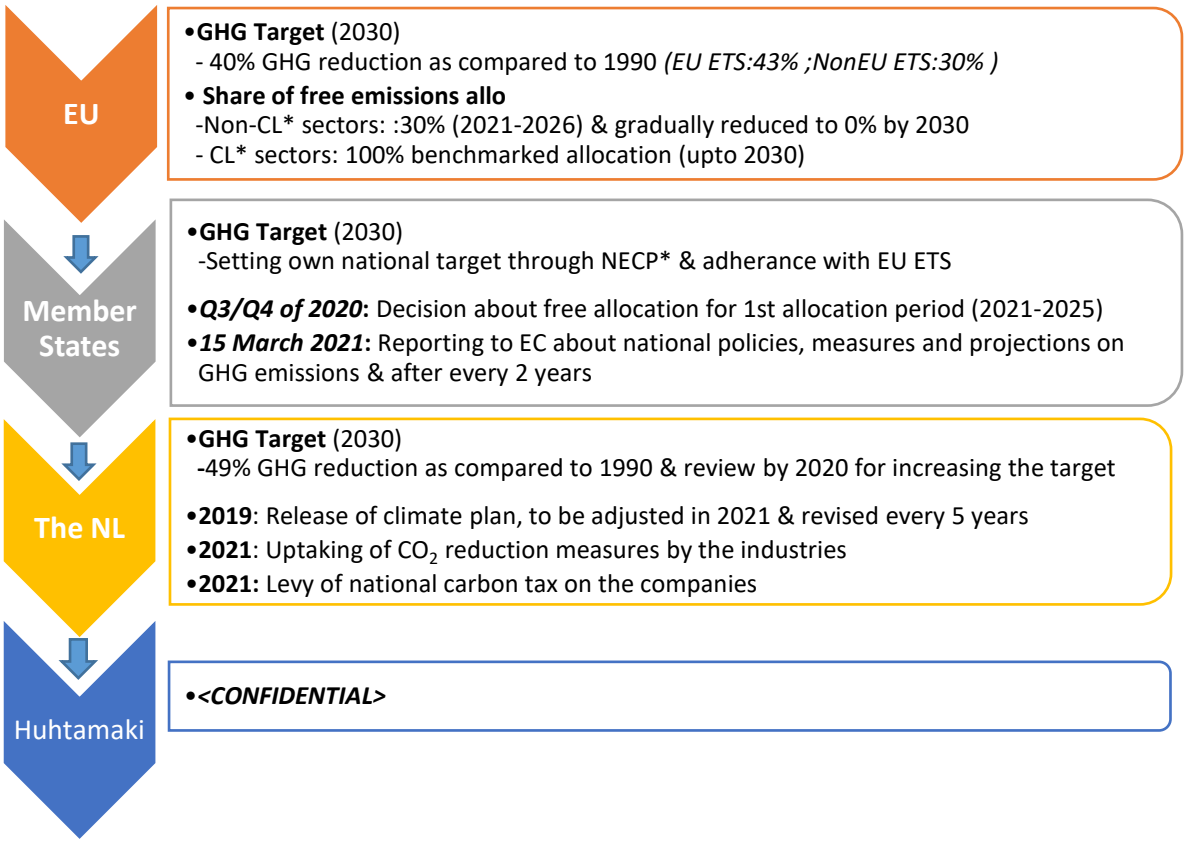

Figure 5-4 GHG emissions requirements summary
*(*CL: Carbon leakage, NECP: Integrated national energy and climate plan)*

To this end, it is observed that the key obligation of the EU is achievement of their GHG emissions target. In respect of ETS sectors, it is achieved by determining the free emission allocation for the ETS companies based on the benchmark values, CL category and the production volume. For non-CL sectors, the share of free emissions allowance shall be reduced to 30% during (2021-2026) and shall be gradually reduced to 0% by 2030. Further, the total free emissions allowance shall be reduced by 2,2% each year during (2021 to 2030). In case of CL sectors, 100% benchmarked allocation shall be provided up to 2030. The EC shall

release the benchmark values for the 1st allocation period (2021-2025) by Q2/Q3 of 2020, while for the 2nd allocation period (2021-2025) by the year 2025.

The EU level directives for EU ETS are directly enforced in the Member States by the national designated authorities, while for non-ETS sectors through national regulations. The Member States should annually report to EC on implementation of EU ETS and determine the company wise free allocation data which is expected to be finalized by Q3/Q4 of 2020 for the 1st allocation period (2021-2025). Besides, they should ensure that the companies monitor their emissions as per approved monitoring plan and submit annual verified emissions report along with surrendering of emission allowances. In the Netherlands, the EU ETS directives are enforced through NEa and in addition to the EU directive, the Dutch government has adopted national regulatory framework based upon the Dutch national climate agreement. It has defined the national level GHG emission reduction target for 2030 and outlined the measures to achieve this target. The most important measures include levying of national carbon tax on the companies and mandatory requirement of undertaking carbon reduction measures of payback period of 5 or less years, both with effect from 2021.

6 CONCLUSIONS AND RECOMMENDATIONS

The present research was carried out on the ground that the current state of knowledge about the future regulatory requirements for the manufacturing companies regarding energy and GHG emissions is fragmented and characterized by uncertainty. This is mainly on account of extensive nature of regulations and overlapping of regulations. Therefore, the present research contributed to systematically analyze and document the relevant regulatory requirements and assess their implications on EU ETS manufacturing companies such as Huhtamaki. The uncertainties were minimized by obtaining clarifications and insights of the relevant stakeholders through discussions and interviews. Nonetheless, it may be acknowledged that the development of regulations is a dynamic process and therefore the regulations can be expected to modify in the future.

In this context, this research report provides the foundation for exploration of future regulatory requirements regarding renewable energy, energy efficiency and GHG emissions during the next decade (2021-2030). It may serve as a guiding document for the ETS manufacturing companies alike Huhtamaki, and for further specific policy research.

6.1 CONCLUSIONS

The key findings of the research are represented in the following Figure 6-1 which address the central research question. These findings were derived from the findings of four research sub-questions dealing with the aspects of supra and national regulatory framework, energy efficiency requirements, renewable energy requirements and GHG emissions requirements respectively.

CENTRAL RESEARCH QUESTION

Which regulatory requirements with respect to energy and climate change mitigation can be expected at the EU and Member state level and what are the implications of these requirements for Huhtamaki's ambition to become energy sustainable by 2030?

First and foremost, it was observed that the EU level regulatory requirements have shaped the obligations for the Member States which in-turn lead to the implications on Huhtamaki. The findings are presented in the order of topmost level (EU) to bottom level (Dutch national level), and thereafter implications on Huhtamaki are mentioned.

EU Level

*** TARGETS (2030):** EE* (32,5%); RE* (32%) & GHG (40%) *(-EU ETS:43% ;Non-EU ETS:30%)*

- 2020: Review of GHG emissions target for increase from 40% to 55%
- 2023: Review of the EE* & RE* targets for increase

FOCUS AREAS

- EE*: -Energy efficiency of the buildings & Energy labels of the products
  (Act for rating of smart readiness of buildings by end of 2019)
- RE*: -RE* in the buildings & Renewable district heating and cooling system
- GHG: -Determining benchmarks by Q2/Q3 of 2020, and thereafter by 2025
  -Determining free emission allowances under EU ETS
  (# Share of free allowances: -Non-CL* sectors: :30% (2021-2026) & reduced to 0% by 2030
  - CL* sectors: 100% benchmarked allocation (upto 2030))

Member States level

*** TARGETS (2030):** Setting own national targets of EE*, RE* & GHG through NECP*

- However, **Must achieve the following**

-EE*: final energy saving of at least 0,8 % each year (2021-2030) & to be achieved through national obligated parties

-RE*: no fixed target, but adequate progress at the reference years 2022, 2025, 2027 & 2030

-GHG: no fixed target, but adherence with EU ETS for ETS companies

•KEY OBLIGATIONS

- Reporting: Development and updating of NECP*, NEEAP* and long-term strategies
- EE* -Energy obligation scheme
  -Promoting energy efficiency of the buildings and products
  (Building automation and control system & Installation of Self-regulating devices)
- RE* -Promotion of RE* in the buildings and renewable district heating and cooling
- GHG - Allocation of free emission allowances for EU ETS 4th trading period (2021-2030)
  - for 1st allocation period (2021-2025) by ***Q3/Q4 of 2020***
  - for 2nd allocation period (2026-2030) by ***2025***

The Netherlands

*** TARGETS (2030)**

- EE*: - Maximum energy consumption of 1950 PJ* (primary) and 1864 PJ* (final) by 2030 & Annual savings of at least 1,5 % of final energy consumption
- RE*: Share of RE of 14% (2020), 16% (2023) & 27-35% (2030)
- GHG: Reduction of 49% by 2030 as compared to 1990 (review of the target by 2020)

•KEY REGULATORY DEVELOPMENTS

- **2019**: Release of final climate agreement & the climate plan (-to be adjusted in 2021 & after 5 years)
- **2019 (Oct)**: Publication of KEV* on annual basis
- **2019 (Dec):** Final NECP* by Dec 2019 & updating by 2024
- **2020:** Preparation of NEEAP*& every 3 years afterwards
- **2020**: Increase of natural gas tax & ODE* tax
- **2021 (Jan):** Amended Environmental Management Act (*Wet Milieubeheer*)
- **2021 (Jan):** Undertaking CO_2 reduction measures by the companies (including RE* & EE* measures)
- **2021 (Jan)**:Levy of national carbon tax on the companies
- **2022 (Q1):** Large scale Nitrogen plant
- **2023 (Jan):** Mandatory energy label for the offices
- **2030**: Phasing out of natural gas production and Closing all coal fired power plants

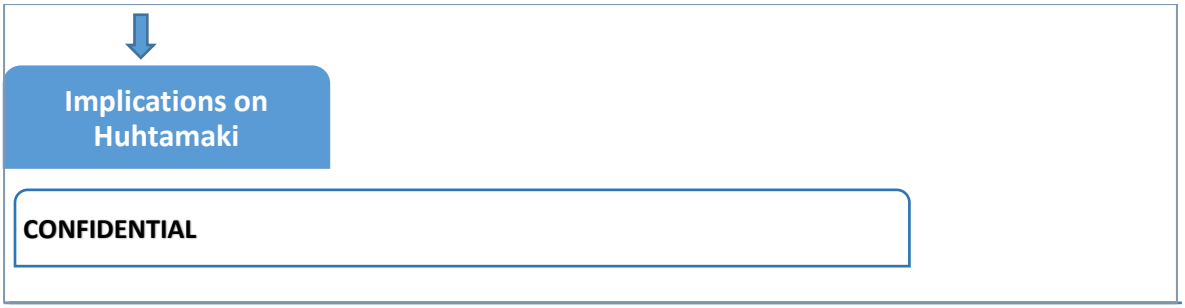

Figure 6-1 Key findings of the research

*(*EE: Energy efficiency, RE: Renewable energy, NECP: Integrated national energy and climate plan, NEEAP: National energy efficiency action plan, PJ: Petajoules, KEV: Klimaat- en Energieverkenning (National climate and energy outlook),* ODE*: *Opslag duurzame energie* (sustainable energy storage)*)*

EU level

The regulatory requirements are driven by the targets of 2030 for energy efficiency (32,5%), renewable energy (32%) and GHG emissions (40%) which the EU must achieve. Notably, the GHG target shall be reviewed for increasing from 40% to 55% in 2020 based on the proposal put forward by the Dutch cabinet. Further, the targets of energy efficiency and renewable energy shall also be reviewed by 2023 for increase. In order to achieve these targets, the EU aims to promote certain focus areas such as energy efficiency of the buildings and energy related products, renewable energy in the buildings, and renewable and efficient district heating and cooling systems. In order to reduce GHG emissions from ETS sectors, the EU aims to gradually reduce the free emission allowances and set the ambitious benchmarks. Towards this pursuit, several directives are enforced at the Union level which specify obligations for both the EU and the Member States. The key directives include Governance of the Energy Union Regulation (*Regulation(EU) 2018/1999)*, Energy Efficiency Directive (*Directive (EU) 2018/2002)*, Renewable Energy Directive (*Directive (EU) 2018/2001)* and EU ETS directive (*Directive (EU) 2018/410).*

Reflection on the Member States

As a contribution to the EU level targets, the Member States should set their own national targets of 2030 for energy efficiency, renewable energy and GHG emissions depending upon their relative contribution to climate change and economic capacity to undertake measures. However, they must meet certain minimum requirements set by the EC in respect of these targets. The progress at the level of Member States shall be monitored by the EC through an integrated monitoring and reporting framework. Under this framework, the main reporting documents include climate action progress report, integrated national energy and climate plan (NECP), national energy efficiency action plan (NEEAP) and long-term strategies of the Member States. Furthermore, the Member states should implement national policies and measures for promoting the focus areas of the EU regarding energy and GHG emissions.

Dutch national level

Aligned with the Member States level target, the Netherlands aims to achieve the targets of energy efficiency (annual 1,5% energy saving), renewable energy (27-35%) and GHG emissions (49%) by 2030. Notably, the national GHG target shall be adjusted in case of increase in the EU level GHG target. In order to achieve these targets, a national level regulatory framework is developed based upon series of agreements including the Energy Agreement (2013), Energy agenda (2016), Coalition agreement (2017) and the national Climate agreement (2019). The important future regulatory developments include release of the climate plan (by 2019), publication of national climate and energy outlook (KEV) on annual basis (by 2019), mandatory CO_2 reduction measures by the industries (by 2021), phasing out the natural gas production from Groningen (by 2030) and closing of all coal-fired plants (by 2030). Furthermore, other significant regulatory requirements include increase of natural gas tax from 2020, levy of national carbon tax on the industries from 2021 and mandatory energy label for offices by 2023.

Implications on Huhtamaki

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<u>RESEARCH SUB-QUESTIONS</u>

As mentioned earlier, the findings of the main research question were derived from the findings in respect of each research sub-question (RQ). These RQs dealt with the aspects of regulatory framework (RQ-I), energy efficiency requirements (RQ-II), renewable energy requirements (RQ-III) and GHG emission requirements (RQ-IV). The key findings against RQs are presented in the following figures including *Figure 6-2* (RQ-I), *Figure 6-3* (RQ-II), *Figure 6-4* (RQ-III) and *Figure 6-5* (RQ-IV).

EU Level

*** Targets (2030)**

- EE*: 32,5%
- RE*: 32%
- GHG reduction: 40% *(EU ETS:43% ;Non-EU ETS:30%)*

- **Key Guiding Requirements** (regarding energy & climate change mitigation)
  - **2020**: Review of GHG emissions target of EU for increase from 40% to 55%
  - **2023**: Review of RE* and EE* targets of EU for increase
  - Annual publication of climate action progress report and reporting to UN

Member States level

*** Targets (2030)**

- EE*: Annual savings of at least 0,8 % of final energy consumption during 2021-2030 (no fixed gross target for 2030)
- RE*: No fixed targets, but adequate progress in achieving the target at the reference years 2022, 2025, 2027 & 2030
- GHG reduction:No fixed targets, but adherance with EU ETS for ETS companies

- **Key Guiding Requirements**
  - **December 2019**: submission of final NECPs* for 2021-2030 (to be updated by 30 June 2024)
  - **1st January 2020**: development of long-term strategies
  - **15 March 2021**: Reporting about national measures and projections on GHG emissions (every 2 years)
  - Annual reporting to EC on implementation of EU ETS
  - Developing NEEAP* for (2021-2023) and updating every 3 years

The Netherlands

*** Targets (2030)**

- EE*: - i) Maximum energy consumption of 1950 PJ* (primary) and 1864 PJ* (final) by 2030 ; ii) Annual savings of at least 1,5 % of final energy consumption
- RE*: Share of RE of 14% (2020), 16% (2023) & 27-35% (2030)
- GHG reduction: 49% by 2030 as compared to 1990

- **Key Guiding Regulatory developments at the national level**
  - **2019**: Approval of final climate agreement (date not available)
  - **2019**: Release of the climate plan (to be adjusted in 2021 & after 5 years)
  - **October 2019**: publication of KEV* on annual basis
  - **1 January 2021**: Uptaking of CO_2 reduction measures by the industries
  - **2030:** Phasing out the natural gas production from Groningen
  - **2030**: Closing all coal-fired plants

Figure 6-2 Key Findings RQ I: Regulatory Framework

*(*EE: Energy efficiency, RE: Renewable energy, NECP: Integrated national energy and climate plan, NEEAP: National energy efficiency action plan, PJ: Peta joules, KEV: National climate and energy outlook)*

EU Level

*** Target of EE* (2030)**

- 32,5 % reduction in the energy consumption of EU by 2030 as compared to their projection made in 2007
- Energy consumption of 1273 Mtoe* (primary) and 956 Mtoe* (final) by 2030
- Review of the EE* target of the EU by 2023 for increase

•Key Requirements regarding EE*

- •A delegated act for rating of smart readiness of buildings by the end of 2019
- •Establishing energy labels for future energy related products

Member States level

*** Target of EE* (2030)**

- Setting own national target of total % reduction in energy consumption by 2030
- Must achieve final energy saving of at least 0,8 % each year (2021-2030)

•Key Requirements regarding EE*

- •Updating NEEAP* for (2021-2023) and every 3 years, and annual progress reporting
- •Achievement of the national target through energy obligation scheme
- •Installation of Building automation and control system & Self-regulating devices in the buildings

The Netherlands

*** Targets (2030)**

- Energy consumption of 1950 PJ* (primary) and 1864 PJ* (final) by 2030 ***(i.e.,*** *approx. 46,57 Mtoe (primary) and 44,52 Mtoe (final)*
- Annual energy savings of at least 1,5 % of final energy consumption

•Key regulatory developments regarding EE* at the national level

- Implementation of updated Environmental Management Act by 2021
- Undertaking of carbon reduction measures by 2021
- All the offices to attain energy label C by 2023

Implications on Huhtamaki

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Figure 6-3 Key Findings RQ II: Energy Efficiency Requirements

*(*EE: Energy efficiency, Mtoe: Million tonnes of oil equivalent, NECP: Integrated national energy and climate plan, NEEAP: National energy efficiency action plan, PJ: Peta joules, KEV: National climate and energy outlook)*

EU Level

*** Target of RE* (2030)**

- 32 % share of renewable energy in the EU by 2030
- Review of the RE* target of the EU by 2023 for increase

•Key Requirements regarding RE*

- •Promoting minimum share of RE* in the buildings & decentralised RE*
- •Renewable and efficienct district heating and cooling system

Member States level

*** Target of RE* (2030)**

- Setting own national target of share of RE* by 2030
- Must attain desired progress in achieving the 2030 target at the reference years 2022, 2025, 2027 & 2030

•Key Requirements regarding RE*

- •Achievement of minimum share of RE* in the new and existing buildings
- •Efficient district heating and cooling using RE* and waste sources
- •Providing information and advice on efficient and renewable alternatives

The Netherlands

*** Target of RE* (2030)**

- Share of RE* of 14% (by 2020); 16% (by 2023) & 27-35% (by 2030)

•Key regulatory developments regarding RE* at the national level

2020: Increasing the natural gas tax & ODE* tax

- •**2021**: Uptaking of CO_2 reduction measures by the industries (including RE* measures)
- •**2022 (Q1):** Large-scale nitrogen plant
- •**2030:** Phasing out the natural gas production & Closing all coal-fired plants

Implications on Huhtamaki

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Figure 6-4 Key Findings RQ III: Renewable Energy Requirements

*(*RE: Renewable Energy, NECP: Integrated national energy and climate plan, ODE: Sustainable energy storage)*

EU Level

*** Target of GHG (2030)**

- 40% GHG reduction as compared to 1990 *(EU ETS:43% ;NonEU ETS:30%)*
- Review of the GHG* target of the EU by 2020 for increasing the target to 55%

- **Key Requirements regarding GHG**
- **2020 (Q2/Q3):** Release of updated product benchmarks for the 4th trading period of EU ETS (2021-2030)
- Share of free emissions allowances
  - -Non-CL* sectors: :30% (2021-2026) & gradually reduced to 0% by 2030
  - - CL* sectors: 100% benchmarked allocation (upto 2030)

Member States level

*** Target of GHG (2030)**

- Setting own national target of GHG* reduction by 2030 through NECP*

- **Key Requirements regarding GHG**
- ***Q3/Q4 of 2020*:** Allocation of free allowances for 1st allocation period (2021-2025) of EU ETS
- ***15 March 2021*:** Reporting about national measures and projections on GHG emissions & after 2 years

The Netherlands

*** Target of GHG (2030)**

- 49% GHG reduction as compared to 1990
- Review by 2020 for increasing the target subject to increase in EU target

- **Key regulatory developments regarding GHG at the national level**

- **2019**: Release of climate plan, to be adjusted in 2021 & revised every 5 years
- **2021**: Uptaking of CO_2 reduction measures by the industries
- **2021:** Levy of national carbon tax on the companies

Implications on Huhtamaki

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Figure 6-5 Key Findings RQ IV: GHG Requirements

*(*CL: carbon leakage, NECP: Integrated national energy and climate plan)*

6.2 RECOMMENDATIONS

Based on the findings of the research, recommendations were proposed for Huhtamaki which can also be relevant for other manufacturing companies in the EU, particularly in the Netherlands. Firstly, the suggested action points for ascertaining the actual regulatory developments on a timely basis are mentioned. Thereafter, certain potential opportunities to meet the regulatory requirements are identified.

Suggested Action Points

In cognizance of the fact that development of regulations is a dynamic process, it is recommended to liaison with the concerned national competent authority to track the regulatory requirements on a periodic basis. Furthermore, the national and EU level developments should be timely pursued by review of amendments in the relevant EU level directives, reports and national plans. In this respect, following guiding documents may be considered as a basis, but not as the exclusive list.

EU level

Table 6-1 Documents to be reviewed (EU level)

S. No.	Particulars	Timeline (for review)
1	Final NECPs* of the Member States	December 2019 & to be updated by July 2024
2	Long-term strategies of the Member States	Jan 2020
3	EU level delegated act for rating the smart readiness of the buildings	Jan 2020
4	NEEAPs* of the Member States (2021-23) & every 3 years	After release of the document & every 3 years afterwards
5	Annual action report (2019) of the Member States	After release of the document & every year
6	EU level directives (as mentioned under Annexure 2)	After issue of amendments

(*NECP: Integrated national energy and climate plans, NEEAP: National energy efficiency action plan)

Dutch national level

Table 6-2 Documents to be reviewed- Dutch national level

S. No.	Particulars	Timeline (for review)
1	Final national climate agreement	2019 (after approval)
2	National climate plan	2019 (after release), to be adjusted in 2021 & revised every 5 years
3	Climate and energy outlook (KEV)	October 2019 & every year
4	Amended environmental management act *(Wet milieubeheer)*	July 2020

Potential Opportunities

Assessment of regulatory requirements for Huhtamaki revealed that reduction in the direct CO_2 emissions should be the prime strategy for Huhtamaki during the next decade (2021-2030). Several measures may be adopted for achieving CO_2 reduction including process efficiency, energy saving, electrification, use of blue and green hydrogen, carbon capture and storage etc. In this respect, following opportunities may be explored by Huhtamaki.

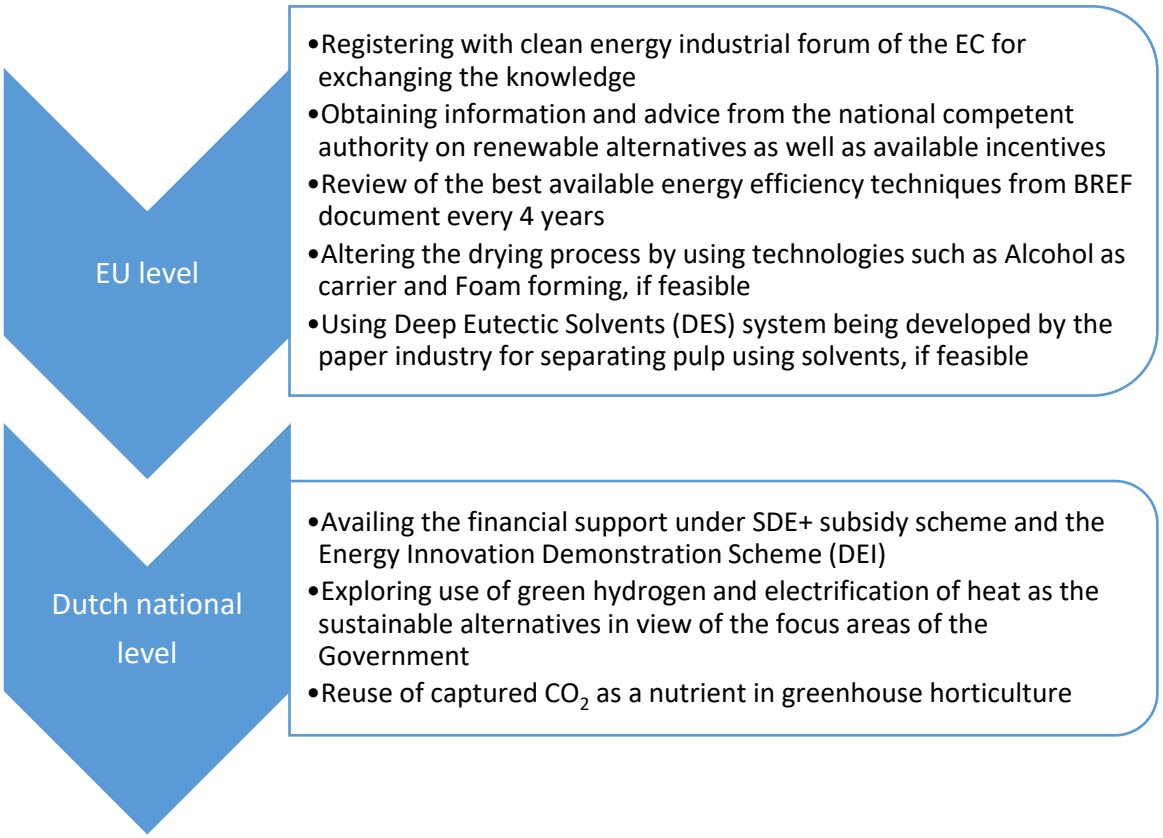

Figure 6-6 Potential opportunities

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ANNEXURES

ANNEXURE 1: FUNCTIONING OF EMISSIONS TRADING SYSTEM (ETS)

The European Commission states that the EU emissions trading system is the EU's key strategy to reduce greenhouse gas emissions. The sectors in the EU ETS are regulated at the EU level and cover large-scale facilities in the power and industry sectors, as well as the aviation sector which accounts for around 45% of the EU's greenhouse gas emissions. EU Emissions Trading System (EU ETS) operates on the 'cap and trade' principle wherein a cap is fixed on the total amount of certain greenhouse gases that can be emitted by installations covered by the system, termed as the approved emission allowances *(European Commission, 2013).*

Each emission allowance grants the right to emit one tonne of CO2, the main greenhouse gas, or the equivalent amount of two other potent greenhouse gases, namely nitrous oxide (N2O) and perfluorocarbons (PFCs) *(European Commission, 2013).* The approved emission allowances can be split up as free allowance and non-free allowance. The non-free allowance can be drawn on from the remaining surplus allowances from previous years or may be bought from other companies through auctioning or from certain types of approved emission-saving projects under Kyoto Protocol's Clean Development Mechanism or Joint Implementation mechanism *(European Commission, 2013).*

The EC states that the allocation of free allowances to the manufacturing industries follows the basis of harmonised rules, which ensures that installations of a given type are treated equally across the EU. To arrive at these rules, ambitious benchmarks are drawn for emissions performance of a given type of installation in consultation with industry. The most efficient installations which are close to these benchmark emission values are rewarded by allocating higher free allowance than less efficient installations. However, installations in sectors and sub-sectors which are deemed to be exposed to a significant risk of 'carbon leakage' are supported to retain their competitiveness. Therefore, such installations which also meet or surpass the benchmark in principle are provided 100% free allowances (European Commission, 2013). Carbon leakage refers to the situation when stringent climate policies reduce the competitiveness of the businesses leading to the transfer of production locations to other countries having laxer regulations on greenhouse gas emissions *(European Commission, 2013).*

The EC observes that this phenomenon could lead to an absolute increase in the total emissions and, therefore, recommends protecting such industries. The EC has prepared an official list of around 170 sectors and subsectors having a significant risk of carbon leakage, which is revised after every five years, based upon clearly defined criteria and after extensive consultation with stakeholders. The current list is applicable for the period 2015-2019 (European Commission, 2013).

ANNEXURE 2: LIST OF EU LEVEL DIRECTIVES COVERED UNDER THE RESEARCH

i. Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action
ii. Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast)
iii. Directive (EU) 2018/2002 of the European Parliament and of the Council of 11 December 2018 amending Directive 2012/27/EU on energy efficiency
iv. Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the Energy Performance of Buildings and Directive 2012/27/EU on Energy Efficiency
v. Regulation (EU) 2017/1369 of the European Parliament and of the Council of 4 July 2017 setting a framework for energy labelling and repealing Directive 2010/30/EU
vi. Commission Implementing Regulation (EU) 2018/2066 of 19 December 2018 on the monitoring and reporting of greenhouse gas emissions
vii. Commission Implementing Regulation (EU) 2018/2067 of 19 December 2018 on the verification of data and on the accreditation of verifiers pursuant to Directive 2003/87/EC of the European Parliament and of the Council
viii. Directive (EU) 2018/410 of the European Parliament and of the Council of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and decision (EU) 2015/1814 (revised EU-ETS directive)
ix. COMMISSION DELEGATED DECISION (EU) 2019/708 of 15 February 2019 supplementing Directive 2003/87/EC of the European Parliament and of the Council concerning the determination of sectors and subsectors deemed at risk of carbon leakage for the period 2021 to.
x. COMMISSION DELEGATED REGULATION (EU) 2019/331 of 19 December 2018 determining transitional Union-wide rules for harmonised free allocation of emission allowances

ANNEXURE 3. MINUTES OF STAKEHOLDER INTERVIEWS

3.1 INTERVIEW WITH THE CR DEPARTMENT (HUHTAMAKI)

<CONFIDENTIAL>

3.2 INTERVIEW WITH THE DUTCH PAPER INDUSTRY (VNP)

Interviewee Name: Corneel Lambregts

Designation: Secretary (Secretaris), VNP (Dutch Paper Industry)

Interviewer Name: Anirudha Pandav

Date: 26/06/2019

Time: 14:00 – 15:00 hr

An interview was conducted with the nodal officer of the Dutch Paper Industry to explore the future implications by 2030 for the Paper Industry and Huhtamaki Fiber Packaging from energy and climate change mitigation context. The discussions were held in respect of three aspects namely Greenhouse gas emissions (GHG), Energy efficiency (EE) and Renewable energy (RE) at the Dutch National level and European level. Before conducting the interview, an extensive desk research was carried out and a checklist of questions was prepared for discussion. The observations of the interview are given below.

GHG emissions

At the Dutch national level, it is speculated that Dutch national climate agreement shall be finalized by 28 June 2019 and published on the public domain which shall be subsequently approved by the cabinet. The anticipated significant changes in the draft climate agreement (from the EU ETS companies perspective) include:- firming up of one of the variants (1,2,3a,3b or 4) of national carbon tax for the companies; finalization of energy, electricity & ODE tax; withdrawal of requirement for company specific carbon reduction plans; specific provision for exemption of carbon leakage companies (if any) etc. Other requirements as outlined in the draft national climate agreement are could remain unchanged.

As per the draft Dutch national climate agreement, the target for the industries is 14.3 MT reduction in GHG emissions by 2030 as compared to 2015, corresponding with the 49% reduction target compared to 1990. This target only corresponds to direct and onsite emissions and indirect emissions are not considered. Hence, the companies are not accounted for their indirect emissions under scope-2 and scope-3 category. Furthermore, the target of 14.3 MT is not allocated as a separate sector-specific target and company-specific target for Paper industry and Huhtamaki Fiber packaging respectively. It is important to note that the only relevant target for EU ETS companies is the applicable benchmark value as determined under ETS and approved by NEA. The preliminary benchmark values are released by EU which are further being reviewed for the appropriate reduction factor and shall likely be finalized by July 2019. The benchmark values and amount of free allocation per company shall generally remain constant for the trading period (2021-2025) and (2026-2030). However, these values might be adjusted in case of shortfall in achieving the EU-wide target.

The companies which emit GHG emissions beyond their free allocation shall be entitled for national carbon tax which would be the difference between the fixed national carbon tax and

auction value. The national carbon tax is likely adjusted upwards in case of shortfall in achieving the national industry target. The exemptions for carbon leakage companies under Dutch national climate agreement are unclear as on date. Additionally, the future requirement (post-2027) of additional ODE levy from the companies is proposed only as a safety measure to achieve the shortfall in the target (if any) and its design is still not worked out.

At the EU level, the requirements for GHG emissions are governed under EU ETS and Huhtamaki Fiber packaging mainly need to ensure that they achieve the latest applicable benchmark values, which are uniform across EU. Free allowances are decided based upon the applicable benchmark value, carbon leakage status and activity levels.

Energy Efficiency

At the Dutch national level, there is no umbrella framework like national climate agreement (as on date) to guide the energy efficiency requirements. Currently, MEE Covenant is a guiding regulation as the part of Energy Efficiency Directive which has set energy efficiency target for Huhtamaki and other EU ETS companies for the period 2017-2020. However, there is no clarity about the future framework for national industry targets and developments after the period 2020. The focus at this stage is mainly on the reduction in GHG emissions.

At the EU level, there are no specific energy efficiency requirements for the paper industry. Energy Efficiency Directive is the overarching directive and, the European Commission (EC) fosters energy efficiency improvements by publishing the BAT BREF document every 4 years which provides the Best Available Techniques for different sectors including production of Pulp, Paper and Board.

Renewable Energy

Currently, there are no direct obligations for the Paper industry and Huhtamaki for using decentralized renewable energy electricity sources such as solar panels, wind turbines or renting the roof to electricity sector, or procurement of green electricity. Further, no such requirement is envisaged in the next decade and the companies shall be accorded freedom to make their choices. Moreover, in respect of renewable heat sources such as geothermal, hydrogen, biogas and residual heat, no such requirement has been enforced currently and envisaged in the future. However, it was emphasized that investment in renewable electricity and heat sources offer potential opportunities in terms of GHG emission reductions and savings of energy taxes.

3.3 INTERVIEW WITH THE DUTCH EMISSIONS AUTHORITY (NEA)

Date: 05/07/2019

Time: 09:00 – 10:00 hr

An interview was conducted with the official of NEa to explore the future regulatory developments by 2030 regarding Greenhouse gas emissions from the ETS [17] companies at the EU and Dutch National level. Before conducting the interview, extensive desk research was carried out and a checklist of questions was prepared for discussion. The observations of the interview are given below.

- *The decision about free emission allocation during 2021-2025*

The NEa is collecting the company wise emissions data and shall send to EC[18] by the end of 2019. Based on this data, the EC shall finalize the benchmark values to be applied for the calculation of free emission allowances during the period 2021-2025. According to the EU, the benchmark decision can be expected in Q2/Q3 of 2020. Afterward, NEa shall prepare company-wise free emission allocation data and send to the companies after approval of the same by EC. This decision shall be taken as soon as possible after the benchmarks are set.

- *National Carbon Tax*

For the purpose of calculation of national carbon tax, EU ETS benchmarks and free allocation data under EU ETS shall be used. The exact value of national carbon tax shall be determined after decision about EU ETS benchmarks and free allocation data is taken. In the agreement, the implementation date of the tax is 2021. There is no decision on the final tax rate, the decision is due to be taken in the course of 2020. The indicative values are 30 euros per tonne (in 2021) and increasing liNEarly to 125-150 euros per tonne of CO2 emitted. But, year-wise values are difficult to determine at this stage.

- *Carbon reduction plan*

As per the Climate Agreement dated 28 June 2019, it shall be mandatory for the companies to undertake carbon reduction measures having payback period of 5 or less years. However, the guidelines and list of approved carbon reduction measures are not yet available. Besides, there is no mandatory requirement for preparing a carbon reduction plan for installations in industry.

[17] Emission Trading System

[18] European Commission

3.4 INTERVIEW WITH THE NETHERLANDS ENTERPRISE AGENCY (RVO)

Date: 15/07/2019

Time: 15:00 – 15:30 hr

An interview was conducted with the official of RVO to explore the future regulatory requirements by 2030 for the companies in the Netherlands such as Huhtamaki. It focused upon aspects such as use of natural gas, energy efficiency obligations, use of renewable energy sources and energy taxes. Before conducting the interview, extensive desk research was carried out and a checklist of questions was prepared for discussion. The observations of the interview are given below.

- *Use of natural gas and switching to other sustainable energy sources*

The Dutch Government in 2018 directed all the industrial Groningen-gas users to switch to natural gas of a high calorific value or to other sustainable sources of energy by the year 2022. However, this requirement is being re-examined by the Government in view of practical constraints of the industries. Further, as outlined in the Climate Agreement, the Government plans to construct a new, large-scale nitrogen plant in the first quarter of 2022 for converting 5 to 7 billion m3 of high-calorific gas into low-calorific gas each year. The revised requirement shall be communicated to the industries likely in 2020.

- *Energy efficiency obligations*

Currently, for EU ETS companies like Huhtamaki the energy efficiency obligations are governed under MEE covenant up to 2020. The MEE covenant shall be replaced with amended Environmental Management Act from 1 January 2021. However, at this stage the specific energy efficiency obligations under this Act are not clear. Furthermore, the date of publishing the guidelines is uncertain.

- *Use of renewable energy sources*

As per the Climate agreement, the Government encourages the industry to adopt renewable energy sources such as solar, geothermal, hydrogen, biomass, use of residual heat and use of green energy. However, it is not expected to have any mandatory requirements for the industries in this regard.

- *Energy Taxes*

The climate agreement proposes to increase the energy tax rate of the first natural gas tranche by 4 cents per m3 in 2020 and 1 cent per m3 in the six years thereafter and lower the energy tax rate of the first bracket for electricity. It also mentions to increase the sustainable energy storage (ODE) tax for the industries. The proposed decrease in the energy tax rate for electricity and increase in the sustainable energy storage (ODE) tax are not available as on date.

ANNEXURE 4. DEFINITION OF KEY CONCEPTS

- *'Greenhouse gases'* are defined as the gases including carbon dioxide, methane, and water vapour which have the property of absorbing infrared radiation emitted from Earth's surface and reradiating it back to Earth's surface, thus contributing to warming of Earth's atmosphere termed as the greenhouse effect *(Mann, 2019)*.
- *'Fossil fuels'* are defined as hydrocarbons such as coal, fuel oil or natural gas, which are formed from the remains of dead plants and animals and leads to emission of carbon dioxide and other greenhouse gases upon combustion ("*ScienceDaily*", n.d.).
- *'Energy efficiency'* is defined as the ratio of output of performance, service, goods or energy, to input of energy *(European Commission, 2012)*.
- *'Primary energy consumption'* is defined as the gross inland consumption *(European Commission, 2012).*
- *'Final energy consumption'* means primary energy consumption excluding the energy consumption by the energy transformation sector and the energy industries themselves *(European Commission, 2012).*
- *'Energy saving'* is defined as the amount of saved energy before and after implementation of an energy efficiency improvement measure while ensuring that external conditions remain same *(European Commission, 2012)*
- *'Energy performance of a building'* is assessed in terms of the energy consumption of the building associated with the typical use of the building, which includes, inter alia, energy used for heating, cooling, ventilation, hot water and lighting *(European Commission, 2010)*
- *'Renewable energy'* means energy from renewable non-fossil sources, namely wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases *(European Commission, 2010)*
- *'Primary energy sources'* include the energy sources which have not undergone any conversion or transformation process *(European Commission, 2010)*
- *'District heating' or 'district cooling'* means the distribution of thermal energy from a central source of production through a network to multiple buildings or sites *(European Commission, 2010)*
- '*Tonne of carbon dioxide equivalent*' means one metric tonne of carbon dioxide (CO_2) or an amount of any other greenhouse gas with an equivalent global-warming potential *(European Commission, 2003)*
- *'Allowance'* means an allowance to emit one tonne of carbon dioxide equivalent during a specified period *(European Commission, 2003)*
- '*Emission factor'* means the average emission rate of a greenhouse gas on combustion of a fuel assuming complete oxidation for combustion and complete conversion for all other chemical reactions *(European Commission, 2018c).*
- *'Product benchmark sub-installation'* means inputs, outputs and corresponding emissions relating to the production of a product for which a benchmark has been set *(European Commission, 2019b)*

- *'Fuel benchmark sub-installation'* means inputs, outputs and corresponding emissions not covered by a product benchmark sub-installation relating to the production of non-measurable heat by fuel combustion *(European Commission, 2019b)*
- '*Verifier'* means a legal person or another legal entity carrying out verification activities and accredited by a national accreditation body *(European Commission, 2018d*)
- '*CO_2 capture'* means the activity of capturing CO_2 from gas streams that would otherwise be emitted, for the purposes of transport and geological storage in a storage site permitted (*European Commission, 2018c*)

Approved action list printing, paper and cardboard

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
BUILDING				
Insulate the building envelope	Limiting heat loss through seams, cracks and other openings in walls and facades.	Limiting heat loss through seams, cracks and other openings in walls and facades:	GA1 to GA3	1 Inquire about the possibilities and costs for a simple thermographic examination (organization)
		- Checking for and sealing seams and cracks in walls and facades.		Check draft strips on doors and frames. (Technic)
		- Checking for and limiting unnecessary open exterior and hall doors.		1 Apply door closers. (Technic)
		- Setting the automatic sliding doors in a summer or winter position.		Do not remove / block facilities (door closers / automatic doors) (behavior)
		- Periodically checking and repairing damage to insulation material.		Provide lockable ventilation grilles (technology)
		- Preventing thermal bridges and limiting heat loss through existing thermal bridges.		2 Check the setting of automatic doors (organization)

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
				3 https://www.rvo.nl/file/best-practice-isolatiepdf (technology / organization / behavior)
				5 Interruptions (between insulation or insulation parts), repairing bad seals (technique) (see 1)
Ventilate a room	Periodic cleaning of the air ducts, filters and fans in the ventilation system.	Prevent or limit loss of efficiency in the ventilation system:	GB1 to GB6	1 For intake and extraction grilles, ensure that they are cleaned periodically. Keep dust and grease free. Channels can be cleaned with pneumatic brushes or rotary brushes. Periodically is 1x per 6-10 years (depending on the pollution) (organization)
		- Periodic cleaning of the air ducts, filters and fans in the ventilation system		2 Indicate filter replacement at the device / Air handling unit with date and brand / type of filter.Include this in the maintenance program and the logbook.(organization) Check filter contamination for pressure drop, with larger AHUs, possibly in GBS. (Technic)
		- Replace air duct filters in time.		
		- Periodically checking and cleaning the heat exchangers		3 Have a periodic inspection of the contamination of heat exchangers, by measuring the temperatures or a visual inspection. Clean contaminated heat exchangers. (organization)
		- Reduction of air pollution sources, which can reduce the ventilation rate.		4 Ensure closed doors (behavior)

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
		- Set the operating time of the ventilation system as economically as possible.		5 Provide switching options for ventilation systems that are easily switchable. (technology) + (switching) behavior
		- Check settings and adjust the frequency control of fans.		6 Ensure that the frequency control is set correctly if it is present, based on the required ventilation air. Adjust this if the space allocation or use changes.
				https://www.rvo.nl/file/best-practice-luchtbehandingsinstallationspdf
	Checking and guaranteeing the efficient operation of insulation material in pipes, fittings and installations.	Checking the setting and ensuring efficient operation and use of insulation material from pipes, fittings and installations in unheated rooms:		1 Increasing energy consumption can be an indication of decreasing insulation.Periodically inspect the insulation visually. Provide a thermographic inspection for outside heat / cold users and / or heat / cold users of a considerable size.(organization)
		- Periodically check the insulation material for and repair of damage to the insulation material (of, for example, heating installations and cooling installations with associated pipes and fittings).		

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
				https://www.rvo.nl/file/best-practice-isolatiepdf
Heating a room	Check settings and ensure efficient operation and use of heat generation.	Check settings and ensure efficient operation and use of heat generation:	GC1 to GC4	1 to 9 Ensure that there is a person in charge of the heating system (or outsourcing) (organization)
		- Check operating hours settings		
		- Check settings of heating limits (adjust to heat requirements)		For larger installations in particular, care for KPIs that are suitable for the organization.(organization)
		- Checking the heating curve settings (adjusting for heat demand)		
		- Check reliability indoor and outdoor sensors (calibration sensors)		Ensure that the installation is set up in a user-oriented manner (in accordance with the use of the building / space).
		- Check whether indoor and outdoor sensors are installed in a representative location (remount / install sensors)		

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
		- Check the temperature settings of the heating system for outside operating hours (night reduction).		
		- Periodic maintenance of the combustion plant.		
		- Lower the temperature of the tap water to a minimum of 60 degrees Celsius.		
		- Checking the return water temperature after distribution and heat emission.		
	Checking and guaranteeing the efficient operation of insulation material in pipes, fittings and installations.	Checking the setting and ensuring efficient operation and use of insulation material from pipes, fittings and installations in unheated rooms:		1 Increasing energy consumption can be an indication of decreasing insulation.Periodically inspect the insulation visually. Provide a thermographic inspection for outside heat / cold users and / or heat / cold users of a considerable size.(organization)

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
		- Periodically check the insulation material for and repair of damage to the insulation material (of, for example, heating installations and cooling installations with associated pipes and fittings).		
				https://www.rvo.nl/file/best-practice-isolatiepdf
Cooling a space	Adjust the cooling system to limit unnecessary cooling.	Effective operation and use of space cooling:	GD1	1 to 6 Ensure that there is a person in charge of the cooling system (or outsourcing) (organization)
		- Adjustment of the cooling system to limit unnecessary cooling.		
		- Switch off cooling system in unused rooms.		For larger installations in particular, care for KPIs that are suitable for the organization.(organization)
		- Periodically clean the condenser and evaporator of the cooling system and check the air intake at the condenser.		

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
		- Periodically checking and maintaining the efficiency of the cooling installation.		Ensure that the installation is set up in a user-oriented manner (in accordance with the use of the building / space).
		- Relocation of heat-producing equipment outside the cooled rooms.		
		- Optimize cooling set points for a higher cooling temperature		3 Clean outside cooling unit (condenser) at least twice a year (spring and autumn). Damage to the fins must be prevented.Cleaning can be part of a maintenance contract.(organization)
Operating a room and outdoor lighting installation	Periodic cleaning of luminaires, lamps, reflectors and associated circuits and controls.	Effective operation and use of room and outdoor lighting:	GE1 to GE13	1 Make someone internally responsible for the lighting.Include the cleaning of the lighting in the maintenance or maintenance contract (organization)
		- Periodic cleaning of luminaires, lamps, reflectors and associated circuits and controls.		2 Include lamp replacement in maintenance protocol (organization)
		- Replace defective lamps in time.		3 Measure any light level (organization). Remove fixtures if activity permits (organization)
		- Adjust the lighting level to the activity.		

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
	Effective operation and use of installations.	Effective operation and use of installations:		1 Provide switching options for installations that are easily switchable. (technology) + (switching) behavior 1 Test the switching options and Approved measure. Example question: Is the installation switched periodically (breaks, weekend, at night)
		- Switch off equipment, machinery and installations that are unnecessarily switched on outside of operating hours.		2 Provide documentation of optimum setpoint settings with operating times for installations to which this applies
		- Periodically check the time settings and reprogram as necessary.		(organization) 2 Example questions: Are summer and winter settings taken into account? Are (factory) settings present in logs?
		- Guaranteeing the proper functioning of installations that are suitable for proper use (in accordance with the design principles).		3 Provide work instructions and manuals per installation (organization);
		- Perform preventive maintenance.		Make sure the people are instructed;

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
				(organization) 3 Example questions: Are there work instructions, for example for switching on the installation. Are there instruction sessions, for example in class, during work meetings, canteen sessions, etc.
				4 Ensure that this is housed internally or is included in maintenance contracts and that the maintenance person reports briefly and / or makes it visible by means of a sticker.
				(organization) 4 Example questions: Are there logs present at the installation? Are there maintenance contracts? Is periodic maintenance carried out and is this visible on the machine (sticker).
FACILITIES				
Operating a combustion plant	Check settings and ensure efficient operation and use of heat generation.	Check settings and ensure efficient operation and use of heat generation:	FA1 to FA12	1 to 9 Ensure that there is a person in charge of the heating system (or outsourcing) (organization)
		- Check operating hours settings		
		- Check settings of heating limits (adjust to heat requirements)		For larger installations in particular, care for KPIs that are suitable for the organization.(organization)

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
		- Checking the heating curve settings (adjusting for heat demand)		
		- Check reliability indoor and outdoor sensors (calibration sensors)		Ensure that the installation is set up in a user-oriented manner (in accordance with the use of the building / space).
		- Check whether indoor and outdoor sensors are installed in a representative location (remount / install sensors)		
		- Check the temperature settings of the heating system for outside operating hours (night reduction).		
		- Periodic maintenance of the combustion plant.		
		- Lower the temperature of the tap water to a minimum of 60 degrees Celsius.		

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
		- Checking the return water temperature after distribution and heat emission.		
	Checking and guaranteeing the efficient operation of insulation material in pipes, fittings and installations.	Checking the setting and ensuring efficient operation and use of insulation material from pipes, fittings and installations in unheated rooms:		1 Increasing energy consumption can be an indication of decreasing insulation.Periodically inspect the insulation visually. Provide a thermographic inspection for outside heat / cold users and / or heat / cold users of a considerable size.(organization)

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
		- Periodically check the insulation material for and repair of damage to the insulation material (of, for example, heating installations and cooling installations with associated pipes and fittings).		
				https://www.rvo.nl/file/best-practice-isolatiepdf
	checking the guarantee of efficient operation of the heat exchanger	To limit the loss of efficiency of the heat exchangers:		Including heat exchangers in maintenance program / planning (organization)
		- Periodically checking and cleaning the heat exchangers.		
Operating a hot water supply, not being a heating installation	Periodic maintenance of taps, check valves and hot water supplies.	Checking settings and ensuring efficient operation and use of hot tap water:	FB1	1 Including hot water system in maintenance planning (organization)
		- Periodic maintenance of taps, check valves and hot water supplies.		2 Do not allow the hot water temperature to exceed 60 ° C (organization / behavior)

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
		- Lower the temperature of the tap water to a minimum of 60 degrees Celsius.		
	Effective operation and use of equipment, machines, installations and computers	Effective operation and use of equipment, machines, installations and computers:		1 Provide switching options for machines that are easy to switch.(technology) + (switching) behavior 1 Test the switching options and Approved measure.Example question: Is equipment switched periodically (breaks, weekend, at night)
		- Switch off equipment, machinery and installations that are unnecessarily switched on outside of operating hours.		2 Provide documentation of optimum setpoint settings with operating times for devices to which this applies
		- Periodically check the temperature and time settings and reprogram as necessary.		(organization) 2 Example questions: Are summer and winter settings taken into account? Are (factory) settings present in logs?

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
		- Ensuring the proper functioning of equipment, machinery and installations that are suitable for proper use (in accordance with the design principles).		3 Provide work instructions and manuals per machine (organization);
		- Perform preventive maintenance.		Make sure the people are instructed;
				(organization) 3 Example questions: Are there work instructions, for example for switching on a machine. Are there instruction sessions, for example in class, during work meetings, canteen sessions, etc.
				4 Ensure that this is housed internally or is included in maintenance contracts and that the maintenance person reports briefly and / or makes it visible by means of a sticker.
				(organization) 4 Example questions: Are logs present with the machines? Are there maintenance contracts? Is periodic maintenance carried out and is this visible on the machine (sticker).

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
	Checking and guaranteeing the efficient operation of insulation material in pipes, fittings and installations.	Checking the setting and ensuring efficient operation and use of insulation material from pipes, fittings and installations in unheated rooms:		1 Increasing energy consumption can be an indication of decreasing insulation.Periodically inspect the insulation visually. Provide a thermographic inspection for outside heat / cold users and / or heat / cold users of a considerable size.(organization)
		- Periodically check the insulation material for and repair of damage to the insulation material (of, for example, heating installations and cooling installations with associated pipes and fittings).		
				https://www.rvo.nl/file/best-practice-isolatiepdf
Operating a compressed air system	Check settings and ensure efficient operation and use of the compressed air system	Checking settings and ensuring efficient operation and use of the compressed air system:	FC1 to FC5	1 to 7: Assign a 1st and 2nd responsible person for the compressed air installation.

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
		- Periodically checking and adjusting the compressed air pressure (where possible, reduce the working pressure).		Ensure that it has sufficient knowledge to perform the management. Put the measures in his / her duties.
		- Checking for and repairing leaks in the compressed air system.		1 Control task, compressed air pressure is often manually increased to have more pressure with, for example, blasting work or blowing clean (behavior)
		- Switching off the compressor compressed air system outside of operating hours.		2 Take care of a measurement and agree on who and when the leaks will be repaired (organization)
		- Shutting off unused compressed air lines.		3 Provide switching options for compressors that are easy to switch. (technology) + (switching) behavior
		- Do not use compressed air for blowing workplaces clean.		5 Provide brooms and / or hand containers. Make sure that the hose reels are not too long so that only the machine can be blown clean and not the floor (technology + behavior)
		- Check and clean the grille for suction of cold outside air.		2.6 and 7

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
		- Periodic maintenance of filters, compressor and cooler in the compressed air system.		If maintenance is outsourced, consult what can be included in regular maintenance. Keep a log of maintenance work on the compressor and work on the compressed air network.https://www.rvo.nl/file/best-practice-document-persluchtinstallation
Operating a steam installation, not being a heating installation	Check settings and ensure efficient operation and use of the steam installation.	Check settings and ensure efficient operation and use of the steam installation:	FD1 to FD4	Assign a 1st and 2nd responsible person for the steam installation.
		- Periodically checking for and repairing leaks at steam traps (steam is let through and not just condensate)		Ensure that it has sufficient knowledge to perform the management. Put the measures in his / her duties. (organization)
		- Periodically checking for and repairing steam and condensate leaks in the steam installation.		1 Check preferably with an ultrasonic meter (not visual).Possibly in a maintenance contract (organization)
		- Decrease steam pressure based on the user who demands the highest pressure.		2 Checking steam plumes.Professional repair (organization)
		- Decrease steam pressure outside of operating hours.		3 Optimum search and possibly step-by-step reduction of steam pressure (organization)

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
		- Shutting off unused steam lines.		4 Realize the lowest possible pressure (possibly step by step).Complete sealing is more difficult due to possible water hammer condensation and heating times.(organization)
		- Periodically checking the economiser and the flue gas condenser for contamination.		5 Physical removal or cold setting (organization)
		- Periodic analysis of the water quality of the water that is used to feed the boiler		6 Include in maintenance (contract) (organization)
				7 Inclusion in maintenance (contract) (organization)
				https://www.rvo.nl/file/best-practice-stoom-en-condensaatsystemenpdf
	Checking and guaranteeing the efficient operation of insulation material in pipes, fittings and installations.	Checking the setting and ensuring efficient operation and use of insulation material from pipes, fittings and installations in unheated rooms:		1 Increasing energy consumption can be an indication of decreasing insulation.Periodically inspect the insulation visually. Provide a thermographic inspection for outside heat / cold users and / or heat / cold users of a considerable size.(organization)

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
		- Periodically check the insulation material for and repair of damage to the insulation material (of, for example, heating installations and cooling installations with associated pipes and fittings).		
				https://www.rvo.nl/file/best-practice-isolatiepdf
	checking the guarantee of efficient operation of the heat exchanger	To limit the loss of efficiency of the heat exchangers:		Including heat exchangers in maintenance program / planning (organization)
		- Periodically checking and cleaning the heat exchangers.		
- Operating an elevator installation	Effective operation and use of equipment, machines, installations and computers.	Effective operation and use of equipment, machines, installations and computers:	- Operating an elevator installation (FE1)	1 Provide switching options for machines that are easy to switch.(technology) + (switching) behavior 1 Test the switching options and Approved measure.Example question: Is equipment switched periodically (breaks, weekend, at night)

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
- Use of information and communication technology		- Switch off equipment, machinery and installations that are unnecessarily switched on outside of operating hours.	- Use of information and communication technology (FF1)	2 Provide documentation of optimum setpoint settings with operating times for devices to which this applies
- Operating an electric motor		- Periodically check the temperature and time settings and reprogram as necessary.	- Operating an electric motor (FH1)	(organization) 2 Example questions: Are summer and winter settings taken into account? Are (factory) settings present in logs?
- Operating a vacuum system		- Ensuring the proper functioning of equipment, machinery and installations that are suitable for proper use (in accordance with the design principles).	- Operating a vacuum system (FI1)	3 Provide work instructions and manuals per machine (organization);
		- Perform preventive maintenance.		Make sure the people are instructed;
				(organization) 3 Example questions: Are there work instructions, for example for switching on a machine. Are there instruction sessions, for example in class, during work meetings, canteen sessions, etc.

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
				4 Ensure that this is housed internally or is included in maintenance contracts and that the maintenance person reports briefly and / or makes it visible by means of a sticker.
				(organization) 4 Example questions: Are logs present with the machines? Are there maintenance contracts? Is periodic maintenance carried out and is this visible on the machine (sticker).
	The elevator installation has lighting:	Effective operation and use of room and outdoor lighting:		1 Make someone internally responsible for the lighting.Include the cleaning of the lighting in the maintenance or maintenance contract (organization)
	Periodic cleaning of luminaires, lamps, reflectors and associated circuits and controls.	- Periodic cleaning of luminaires, lamps, reflectors and associated circuits and controls.		2 Include lamp replacement in maintenance protocol (organization)
		- Replace defective lamps in time.		3 Measure any light level (organization). Remove fixtures if activity permits (organization)
		- Adjust the lighting level to the activity.		

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
Operating an air humidification system	Check settings and ensure effective operation and use of the water humidifier	Check settings and ensure efficient operation and use of the water humidifier:	FG1	Include in maintenance planning (organization)
		- Check for and remove dirt with scale deposits		
	Effective operation and use of equipment, machines, installations and computers.	Effective operation and use of equipment, machines, installations and computers:		1 Provide switching options for machines that are easy to switch.(technology) + (switching) behavior 1 Test the switching options and Approved measure.Example question: Is equipment switched periodically (breaks, weekend, at night)
		- Switch off equipment, machinery and installations that are unnecessarily switched on outside of operating hours.		2 Provide documentation of optimum setpoint settings with operating times for devices to which this applies

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
		- Periodically check the temperature and time settings and reprogram as necessary.		(organization) 2 Example questions: Are summer and winter settings taken into account? Are (factory) settings present in logs?
		- Ensuring the proper functioning of equipment, machinery and installations that are suitable for proper use (in accordance with the design principles).		3 Provide work instructions and manuals per machine (organization);
		- Perform preventive maintenance.		Make sure the people are instructed;
				(organization) 3 Example questions: Are there work instructions, for example for switching on a machine. Are there instruction sessions, for example in class, during work meetings, canteen sessions, etc.
				4 Ensure that this is housed internally or is included in maintenance contracts and that the maintenance person reports briefly and / or makes it visible by means of a sticker.

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
				(organization) 4 Example questions: Are logs present with the machines? Are there maintenance contracts? Is periodic maintenance carried out and is this visible on the machine (sticker).
PROCESSES				
- Heating of products and / or process baths	checking the guarantee of efficient operation of the heat exchanger	To limit the loss of efficiency of the heat exchangers:		Including heat exchangers in maintenance program / planning (organization)
- Editing, gluing, coating or laminating paper or cardboard		- Periodically checking and cleaning the heat exchangers.		
- Cooling of products and / or process baths				
	process bath: Check for and prevent water leaks	Checking the effective operation of process installations for the efficient use of process water:		1 Check for leaks in daily round (behavior)
		- Checking for and preventing water leaks.		2 Periodic measurement based on KPI management (organization)

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
		- Reduce the use of supllete water at the blanchers		3 Optimization and measurement of water consumption vs production (KPI) (organization)
		- Reduce the use of water with the ice water coolers.		4 Visual steam / vapor check (behavior)
		- Checking for and limiting evaporation losses.		
	Effective operation and use of equipment, machines, installations and computers.	Effective operation and use of equipment, machines, installations and computers:		1 Provide switching options for machines that are easy to switch.(technology) + (switching) behavior 1 Test the switching options and Approved measure.Example question: Is equipment switched periodically (breaks, weekend, at night)
		- Switch off equipment, machinery and installations that are unnecessarily switched on outside of operating hours.		2 Provide documentation of optimum setpoint settings with operating times for devices to which this applies
		- Periodically check the temperature and time settings and reprogram as necessary.		(organization) 2 Example questions: Are summer and winter settings taken into account? Are (factory) settings present in logs?

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
		- Ensuring the proper functioning of equipment, machinery and installations that are suitable for proper use (in accordance with the design principles).		3 Provide work instructions and manuals per machine (organization);
		- Perform preventive maintenance.		Make sure the people are instructed;
		- Adjustment of the cooling system to limit unnecessary cooling.		(organization) 3 Example questions: Are there work instructions, for example for switching on a machine. Are there instruction sessions, for example in class, during work meetings, canteen sessions, etc.
		- Switch off cooling system in unused rooms.		4 Ensure that this is housed internally or is included in maintenance contracts and that the maintenance person reports briefly and / or makes it visible by means of a sticker.
		- Periodically clean the condenser and evaporator of the cooling system and check the air intake at the condenser.		(organization) 4 Example questions: Are logs present with the machines? Are there maintenance contracts? Is periodic maintenance carried out and is this visible on the machine (sticker).

Activity	DBO goal	Measure (s) DBO	Printing, Paper and Cardboard **measure no.**	Integration (for the company) Technology / organization / behavior If applicable
		- Periodically checking and maintaining the efficiency of the cooling installation.		
		- Relocation of heat-producing equipment outside the cooled rooms.		
		- Optimize cooling set points for a higher cooling temperature		

(Ref. https://www.infomil.nl/onderwerpen/duurzaamheid-energie/energiebesparing/erkende-maatregelen/)

ANNEXURE 6: METHODOLOGY FOR CALCULATING FINAL FREE EMISSION ALLOWANCES

Final annual amount of emission allowances = Value of relevant benchmark (product/heat/fuel/process) for the sub-installation * Relevant historic activity level * Annual reduction factor *(European Commission, 2019b, REGULATION (EU) 2019/331,P.15,Para.2).*

The annual reduction factors applicable for allocating free emission allowances are provided in the following table.

Year	Value of the factor
2021	0,300
2022	0,300
2023	0,300
2024	0,300
2025	0,300
2026	0,300
2027	0,225
2028	0,150
2029	0,075
2030	0,000

(Ref. (European Commission, 2019b, REGULATION (EU) 2019/331,P.48))

In case of sectors or subsectors deemed to be exposed to a significant risk of carbon leakage, the reduction factor of 1 shall be applied, which implies that the installations meeting the benchmark value under this category receive all free allowances (European Commission, 2019b, *REGULATION (EU) 2019/331,P.15,Para.4*).