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Climate change and mitigation policies:

the case of the Republic of Korea

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Abstract

Sulla scena internazionale odierna, il tema del cambiamento climatico ha assunto un ruolo di primo piano. La causa principale di tale cambiamento l'innalzamento delle temperature medie mondiali, fenomeno conosciuto come riscaldamento globale, a sua volta dovuto agli elevatissimi livelli di gas serra (o gas a effetto serra) immessi nell'atmosfera a cause delle attività dell'uomo. Se non si riducono le emissioni di questi gas la situazione diventerà sempre più grave: un ulteriore aumento delle temperature porterà ad un aumento di fenomeni naturali estremi e causerà ingenti danni agli ecosistemi, con conseguente perdita di risorse. La Corea del Sud rappresenta uno dei maggiori produttori di gas serra mondiale e per questo motivo da tempo prende parte attiva ai tentativi internazionali di contrastare il fenomeno del cambiamento climatico. L'argomento di questa tesi, quindi, sono le politiche di mitigazione al cambiamento climatico messe in atto e sviluppate dalla Corea del Sud. L'obiettivo è analizzare tali politiche e cercare di capire se possano essere efficaci nella lotta al cambiamento climatico; si cercherà inoltre di presentare la posizione della Corea a livello internazionale in tema di clima. La tesi si basa sull'analisi informazioni e dati presenti in fonti bibliografiche di diversa natura, tra cui articoli in riviste specializzate, articoli di quotidiani, siti internet, libri, rapporti e documenti ufficiali.

La tesi è divisa in tre capitoli. Il primo capitolo della tesi funge da sorta di introduzione su, da un lato, il tema del cambiamento climatico, e, dall'altro, la Corea del Sud, paese poco conosciuto, sopratutto se paragonato ai sui vicini asiatici, Cina e Giappone.

Nonostante siano anni che gli scienziati stanno studiando questo fenomeno e le informazioni fondamentali siano ormai alla portata di tutti, c'è ancora un po' di confusione su ciò che è il cambiamento climatico, le sue cause e conseguenze e cosa si può fare per impedire il suo progressivo peggioramento. Per questo motivo la prima parte del Capitolo Uno sarà incentrata su alcuni punti chiave relativi a questo fenomeno. Innanzitutto, verrà sottolineato che i cambiamenti climatici si sono sempre verificati in maniera ciclica nel tempo. Il cambiamento climatico di oggi, tuttavia, rappresenta una minaccia perché sta accadendo a un ritmo incredibilmente veloce, a causa di un massiccio aumento delle emissioni di gas serra nell'atmosfera causate dall'attività umana negli ultimi decenni. Le emissioni di gas serra sono parte integrante dei processi naturali e producono il cosiddetto

effetto serra, grazie al quale la Terra è abbastanza calda perché esista vita sul pianeta. I più elevati livelli di emissioni di gas serra negli ultimi anni hanno però fatto sì che più calore rimanesse intrappolato all'interno dell'atmosfera, causando un rapido aumento delle temperature medie. Questo fenomeno è conosciuto come riscaldamento globale. Questo fenomeno di innalzamento delle temperature sta iniziando ad avere una grande varietà di conseguenze negative, che non potranno che peggiorare nel tempo, tra cui lo scioglimento dei ghiacci, l'aumento del livello del mare, il peggioramento della qualità dell'acqua e una diminuzione della sua offerta, perdita di biodiversità e danni agli ecosistemi. Come si vedrà, questi effetti, già di per sé estremamente gravi, influenzeranno a loro volta il funzionamento della società umana: la scarsità di cibo e acqua, e un aumento dell'inquinamento di quest'ultima, combinati con un potenziale aumento delle malattie, causeranno un aumento di conflitti, sia nazionali che internazionali, di crisi umanitarie e di flussi migratori, andando di conseguenza ad alterare gli equilibri geopolitici mondiali. Inoltre, diversi gruppi di persone saranno interessati in modi e con intensità differenti. I più vulnerabili saranno i poveri, gli anziani, i bambini piccoli, gli immigrati e le comunità indigene. Subito dopo questa breve esposizione sulle cause e le conseguenze del cambiamento climatico, verranno introdotte e spiegate le due diverse soluzioni che gli Stati hanno a disposizione per affrontare questa minaccia: adattamento e mitigazione. Le strategie di adattamento mirano a ridurre la vulnerabilità degli Stati agli eventi naturali, mentre le strategie di mitigazione cercano di fermare l'avanzamento del riscaldamento globale e dei cambiamenti climatici riducendo i livelli di gas serra nell'atmosfera, riducendo le emissioni o catturando i gas già rilasciati e conservandoli in pozzi sotterranei. Dal momento che affrontano il problema da due prospettive differenti, queste soluzioni vanno perseguite dagli Stati contemporaneamente e in maniera congiunta.

Successivamente si passerà a delineare brevemente i passaggi fondamentali nel processo di cooperazione internazionale, partendo dalla lenta accettazione del cambiamento climatico come problema concreto fino ad arrivare ai due risultati principali: il protocollo di Kyoto del 1997 e l'accordo di Parigi del 2015.

La seconda parte del Capitolo Uno, invece, si concentrerà sulla Corea del Sud. Dopo una breve panoramica generale della geografia e della struttura socio-economica del paese, necessarie per capire alcune delle problematiche il paese deve affrontare in tema di politiche climatiche, sopratutto nel settore energetico, saranno presentati gli sforzi

internazionali della Corea per combattere i cambiamenti climatici. In particolare, sarà evidenziata la posizione unica della Repubblica di Corea sulla scena internazionale: sebbene sia riconosciuta come parte non-Annex I sotto il regime UNFCCC, vale a dire un paese in via di sviluppo, la Corea è anche membro dell'OCSE e i suoi livelli di emissioni di gas serra sono gli stessi dei paesi sviluppati. A causa di questa posizione intermedia, come si vedrà, la Corea del Sud può svolgere un ruolo ponte tra i paesi sviluppati e quelli in via di sviluppo. Verranno inoltre presentati alcune iniziative internazionali di cui la Corea è stata fautrice.

Successivamente, verrà dedicato un paragrafo alla descrizione dei principali attori interni in Corea in materia di cambiamenti climatici. Tale analisi è basata sui risultati di uno studio, realizzato da tre ricercatori coreani, che ha analizzato tali attori e il modo in cui essi interagiscono gli uni con gli altri. Innanzitutto gli attori possono essere suddivisi in tre categorie: organizzazioni governative, organizzazioni imprenditoriali e organizzazioni della società civile. Come si vedrà, lo studio mostra che in Corea il governo e i suoi organi sono i principali attori del cambiamento climatico e i più attivi propugnatori delle politiche del cambiamento climatico. Le organizzazioni intergovernative interagiscono principalmente tra loro e con le organizzazioni imprenditoriali. Ciò è dovuto al fatto che le organizzazioni della società civile, sebbene abbiano a volte contatti con gli altri due gruppi, tendono ad interagire principalmente tra loro stesse.

Infine, nell'ultimo paragrafo del Capitolo Uno verranno brevemente esposte le principali strategie di adattamento messe in atto dalla Corea del Sud.

Il Capitolo Due sarà incentrato sulle politiche di riduzione delle emissioni di gas a effetto serra attuate dalla Corea del Sud con lo scopo di rispettare l'obiettivo sancito dall'Accordo di Parigi di mantenere un aumento della temperatura globale in questo secolo ben al di sotto di 2°C rispetto ai livelli preindustriali e di proseguire gli sforzi per limitare ulteriormente l'aumento della temperatura a 1,5°.

In primo luogo, sarà esposto il contenuto della prima Nationally Determined Contribution coreana del 2016. Come si vedrà, in questo documento, la cui redazione periodica (ogni quattro anni) è richiesta a tutti i paesi membri dall'Accordo di Parigi, la Repubblica di Corea si è impegnata a ridurre le emissioni di gas serra del 37% entro il 2030 rispetto ai livelli business-as-usual. Nello stesso anno, il governo sudcoreano aveva inoltre lanciato a livello nazionale il suo primo Basic Plan for Climate Change Response, un piano politico

generale con strategie a medio e lungo termine e piani d'azione specifici per combattere i cambiamenti climatici.

Si vedrà poi che, per guidare gli sforzi nazionali nella riduzione delle emissioni di gas serra, nel corso degli anni il governo coreano ha lanciato una serie di tabelle di marcia per la riduzione delle emissioni di gas a effetto serra, contenenti i dettagliati tassi di riduzione attesi e possibili strategie generali e settoriali per raggiungere questi obiettivi. La prima tabella di marcia, conosciuta come First Greenhouse Gas Reduction Roadmap, è stata realizzata nel 2014 per rispettare un impegno del 2009 di ridurre i livelli di emissioni del 30% nel 2020. Successivamente, nel 2016 è stata rilasciata una nuova tabella di marcia per la riduzione dei gas a effetto serra, la Greenhouse Gas Reduction Roadmap 2030. Si è trattato di una revisione della Roadmap originale del 2014 per adattare i tassi di riduzione nazionali previsti agli impegni assunti dalla Corea nella sua Nationally Determined Contribution. Si vedrà inoltre come, confrontando le due tabelle di marcia, risulti chiaro che il nuovo piano prevede tassi di riduzione più bassi in tutti i settori, ad eccezione della gestione dei rifiuti. Infine, nel 2018 è stata rilasciata una versione rivista della Roadmap 2030. Questa nuova revisione è stata causata da forti critiche alla versione originale, accusata di assegnare gran parte della riduzione delle emissioni a riduzioni all'estero senza mappare efficacemente piani d'azione specifici a tal fine. Ancora, nel Capitolo Due verrà brevemente illustrato il funzionamento del sistema nazionale di scambio di quote di emissione di gas a effetto serra (Emissions Trading System, anche noto come K-ETS), lanciato nel gennaio 2015 dalla Corea del Sud, sul modello di quello europeo, precedentemente spiegato nel Capitolo Uno. Il Korea Emissions Trading System (K-ETS) mette un tetto alle emissioni di gas a effetto serra dei partecipanti al programma e prevede l'assegnazione di un numero corrispondente di quote di emissioni. I partecipanti devono misurare le proprie emissioni annuali e compensarle con un corrispondente quantitativo di quote. I partecipanti che emettono meno della loro assegnazione possono vendere le quote in eccesso, mentre quelli che non hanno abbastanza quote per coprire le loro emissioni annuali devono acquistarle. Un altro elemento della strategia di mitigazione della Corea è il GHG & Energy Management Target, attivo dal 2010. Questo programma designa le aziende con una grande quantità di emissioni di gas serra e di consumo di energia come soggetti di un target management, quindi impone loro degli obiettivi di riduzione; la fase successiva del programma consiste nel verificare e tenere traccia delle prestazioni delle

aziende selezionate.

Dopo aver completato la presentazione di queste strategie nazionali di mitigazione, verrà rapidamente illustrato il contenuto del Biennial Update Report e della National Communication. Si tratta di due documenti che i membri della Convenzione quadro delle Nazioni Unite sul cambiamento climatico (United Nations Framework Convention on Climate Change, UNFCCC) devono presentare regolarmente come aggiornamento sui loro sforzi di mitigazione e adattamento.

Infine nell'ultima parte del capitolo verranno analizati i dati raccolti da tre centri di ricerca il cui obiettivo è monitorare i progressi nella lotta al cambiamento climatico (Climate Action Tracker, Climate Transparency and Climate Change Performance Index) e raccolti nei loro rapporti periodici e sulle loro pagine web, per vedere se le politiche coreane sono efficaci. Sfortunatamente, come si vedrà, le ricerche di Climate Action Tracker, CCPI e Climate Transparency dimostrano che i piani e le politiche attuati dalla Repubblica di Corea non sono abbastanza ambiziosi e non saranno sufficienti per raggiungere l'obiettivo dei 2°C, per non parlare dell'obiettivo più rigoroso di 1,5°C. I rapporti sottolineano che l'unico elemento positivo viene dal settore energetico, in particolare per quanto riguarda l'implementazione e l'uso di nuove fonti di energia rinnovabili.

Per questo motivo, l'ultimo capitolo tratterò del principale settore produttore di gas a effetto serra della Repubblica di Corea, l'energia. La Corea del Sud è un paese ad alta intensità energetica e le principali fonti energetiche sono i combustibili fossili e il nucleare, mentre il tasso di fonti rinnovabili è basso, circa il 7 percento. Oltre alle politiche settoriali contenute nei piani generali per la riduzione delle emissioni di gas a effetto serra presentati nel Capitolo Due, la Corea ha progettato specifici piani energetici dettagliati. Come si vedrà, in Corea del Sud, i due pilastri delle strategie energetiche nazionali sono i Basic Energy Plans e i Master Plans for Electricity Demand and Supply. I Basic Energy Plans rappresentano la principale fonte di orientamento su tutto ciò che attiene all'energia, compresa la definizione di politiche energetiche locali e specifiche per il settore da medio a lungo termine. I Master Plans for Electricity Demand and Supply forniscono la direzione di base della domanda e dell'offerta di energia, nonché una previsione a lungo termine di domanda e offerta energetiche, un piano per le installazioni, la gestione della domanda e dell'offerta di energia e altre questioni correlate. Come detto sopra, le principali fonti energetiche della Corea sono i combustibili fossili, in particolare carbone e petrolio, e

l'energia nucleare. L'utilizzo di queste fonti di energia è collegato ad una serie di rischi, e questo fa sorgere problemi nella creazione e gestione delle politiche energetiche. Per quanto riguarda l'energia nucleare, dopo l'incidente di Fukushima nel 2011, all'interno della popolazione coreana sono iniziate a crescere le preoccupazioni per i rischi delle centrali nucleari, in particolare derivanti da potenziali danni a queste ultime, aumentante ulteriormente in seguito ad un terremoto di magnitudo 5,8 nel 2016, il cui epicentro era a soli 28 km dalla centrale nucleare di Wolsung, nel Sud della penisola coreana. A peggiorare la situazione, inoltre, è il fatto che la densità dei reattori nucleari in Corea è la più alta del mondo e che questi si trovano spesso vicino ad aree altamente abitate: ad esempio, la popolazione che vive in un raggio di 30 km dalle centrali nucleari di Wolsung è di 1,3 milioni di persone. Ciò significa che gli effetti di un incidente sarebbero estremamente gravi. Relativamente all'uso di combustibili fossili, invece, il problema principale è rappresentano dagli alti livelli di polveri sottili che le industrie alimentate con queste fonti energetiche producono.

Come si vedrà, in risposta a questi problemi, l'attuale governo coreano, guidato da Moon Jae-in, ha lanciato una tabella di marcia per le energie rinnovabili, la Renewable Energy Roadmap 3020. Questa tabella di marcia promette un aumento della percentuale di energia rinnovabile nel mix energetico nazionale dal 7% al 20% entro il 2030 con un successivo aumento al 35 percento nel 2040. Ciò porterebbe, secondo la tabella di marcia, a una riduzione delle centrali elettriche a carbone e ad un'accelerazione della progressiva eliminazione del nucleare. Sebbene la tabella di marcia 3020 rappresenti una risposta, seppur parziale, alla questione energetica del paese e contribuirebbe a rafforzare i suoi sforzi di riduzione delle emissioni di gas a effetto serra, si vedrà che il governo coreano ha ancora qualche ostacolo da superare per implementarla con successo.

In primo luogo, sebbene sia aumentato il consenso pubblico sulla riduzione dell'energia nucleare, molti coreani credono ancora che questa fonte energetica sia una sorta di male necessario. Allo stato attuale, l'eliminazione graduale del nucleare è ancora una questione controversa e l'opinione pubblica coreana è divisa tra coloro che si oppongono al piano del governo e coloro che lo sostengono. Un altro ostacolo che la Corea deve affrontare nell'aumentare la sua percentuale di energia prodotta da fonti rinnovabili è che il costo dell'energia rinnovabile e delle centrali elettriche a gas naturale è, finora, molto più elevato rispetto ai combustibili fossili e alle centrali nucleari. Ciò, a sua volta, significa che un

aumento delle fonti energetiche rinnovabili comporterebbe un aumento dei costi dell'elettricità. Una soluzione sarebbe quella di incorporare nella tassa sull'elettricità i costi ambientali e sociali derivanti dalla generazione di energia basata su fossili e nucleare. Un'altra soluzione sarebbe incentivare lo sviluppo tecnologico che permetterebbe di aumentare l'efficienza energetica e rendere le fonti rinnovabili più competitive sul mercato dell'energia.

Come si è detto sopra, nel Capitolo Uno si vedrà che in Corea il principale attore e promotore delle politiche in materia di cambiamenti climatici è il governo; questo vale anche per le sue politiche energetiche. Nel Capitolo Tre si vedrà però che l'amministrazione Moon sta cercando la situazione, muovendo gradualmente verso una struttura più decentralizzata, in particolare per quanto riguarda la creazione di politiche in ambito energetico e facendo sì che anche le entità private e le organizzazioni della società civile assumano un ruolo più attivo nella progettazione e realizzazione di progetti energetici, con particolare riguardo all'uso delle energie rinnovabili.

Legata all'elevata dipendenza della Corea dall'energia nucleare è la questione della gestione dei rifiuti radioattivi. Nel Capitolo Tre, si vedrà che ad oggi, la Corea del Sud non ha ancora una chiara politica nazionale sulla gestione delle scorie nucleari e adotta un approccio "aspetta e vedi" in relazione alla gestione di scorie ad alta attività (o 3° grado, le più pericolose), secondo il quale le scorie nucleari sono temporaneamente immagazzinate in sito, nell'impianto del reattore che le ha prodotte. Sfortunatamente, le autorità coreane prevedono che le strutture di stoccaggio raggiungeranno la loro capacità massima in pochi anni. I rifiuti a media e bassa attività, invece, generati dalle centrali nucleari, sono sottoposti a processi di trattamento come riduzione del volume, stabilizzazione, ecc., presso le strutture di trattamento in loco, dove vengono anche temporaneamente stoccati prima di essere trasportati nel centro di smaltimento di Wolsong per lo smaltimento finale.

Nel Capitolo Tre si osserverà infine che, oltre ad essere una società ad alta intensità energetica, la Corea è anche povera di energia, a causa della sua conformazione geografica vista nel Capitolo Uno (la penisola coreana è prevalentemente montuosa). che significa che il paese deve importare circa il 90 percento della sua energia e delle sue fonti energetiche. Ciò apre la questione della sicurezza energetica e della diplomazia energetica. Nell'ultimo paragrafo del Capitolo Tre quindi, dopo aver dato una definizione di questi due concetti, sarà presentata la principale arena di cooperazione della Corea in ambito energetico, il

Nord-Est asiatico. Finora la cooperazione regionale è stata per lo più bilaterale e anche se i paesi dell'Asia Nord-orientale comprendono la necessità di una maggiore cooperazione energetica, vi sono ancora importanti fattori politici e sociali che impediscono la realizzazione di ulteriori sforzi multilaterali. Un passo avanti in questa direzione è rappresentato dal lancio del progetto Asian Super Grid, per la realizzazione di una rete elettrica sottomarina che colleghi tutto il continente. A questo progetto hanno già aderito Cina, Corea del Sud, Russia, Giappone e Mongolia. Si vedrà inoltre che un'altra importante arena di cooperazione energetica per l'Asia e la Corea del Sud potrebbe essere l'Europa. Sebbene nell'ambito della precedente amministrazione gli sforzi della diplomazia energetica fossero notevolmente diminuiti, il governo Moon ha cercato di ripristinare la cooperazione internazionale in materia di energia; in particolare, ha avviato dialoghi bilaterali e multilaterali con gli Stati Uniti e il Giappone e ha pianificato una serie di missioni diplomatiche nei principali paesi di Medio Oriente, Africa, Sud e Centro America ed Eurasia.

Index

Introduction

One of the greatest challenges the world will have to face in the years to come is climate change. Even though scientists have been studying this phenomenon for decades, the issue have rapidly become more and more urgent in recent years do the increase in its perceived effects, such as an increment in natural disasters. In the next years we will see an even greater escalation of extreme weather events, such as floods, droughts, destructive storms, etc. due also to the current inability of the international community to find common solutions and strategies to face the problem. Climate change will also have economic and social consequences, such as more humanitarian crises, stronger mitigation flows, regional, national and international conflicts due to scarcity of resources, which in turn will alter the geopolitical balances of future international relations.

The question, then, is why it is so difficult for the world to come together and face this challenge in an effective manner. There are many reasons for this. One is that, even though scientists have long been able to prove that the current climate change is caused by very high levels of greenhouse gases released in the atmosphere by human activity, there exist many, within and without the scientific community, that don't believe in climate change or its causal relation with human action, the skeptics of climate change. Among this group there are many different approaches and theories. There are those who do not believe that today's climate change is anything different from the cyclical changes in climate the planet has experienced in its thousands of years of existence, and thus it is nothing to worry about. Then, there are those that, although not denying the possibility of the danger of climate change, accuse what they consider the mainstream scientific community of presenting false and/or manipulated researches and data to promote a certain narrative of danger and fear, while discordant voices are shut down. Others still accept that today's climate change is a problem but do not recognize it as being caused by human activity[1]. These are only few of the different theories and arguments growing within this community of skeptics on climate change. Another reason why it is so difficult to effectively implement actions and strategies to stop climate change is the Giddens Paradox, theorized by Anthony Giddens: «since the dangers posed by global warming aren't tangible, immediate or visible in the course of day-to-day life, many will sit on their hands and do

1 Anthony Giddens, *La politica del cambiamento climatico*, Milano, Il Saggiatore, 2015, pp. 27-28

nothing of a concrete nature about them»[2]. This Giddens paradox, is made worse by a phenomenon known in social psychology as Future Discounting: people find it difficult to attribute the same level of reality to the future as they do the present, which means they will take a small reward offered now in preference to a much larger one offered at some unspecified moment in the future. This means also that people prefer a small gratification in the present instead of the long-term gratification of having taken action and avoided a great future risk[3]. The Giddens paradox also explains in part why international cooperation on climate has been a difficult and not fully successful process, as we will see in later chapters. States have found it difficult to put aside their present personal interests and gains in order to reach the common goal of reducing climate change and avoiding the dangers it poses to the whole of humankind.

As an article in The Economist from last year reminds us

> «Climate change is a dire threat to countless people—one that is planetary in scope if not in its absolute stakes. It will displace tens of millions, at the very least; it will disrupt farms on which billions rely; it will dry up wells and water mains; it will flood low-lying places—and, as time goes by, higher-standing ones, too. True, it will also provide some opportunities, at least in the near term. But the longer humanity takes to curb emissions, the greater the dangers and sparser the benefits—and the larger the risk of some truly catastrophic surprises. The scale of the implications underlines [...] it is not just an environmental problem alongside all the others—and absolutely not one that can be solved by hair-shirt self-abnegation. Change by the people who are most alarmed will not be enough. What is also needed is change in the lives of those who do not yet much care. Climate is a matter for the whole of government. It cannot be shunted off to the minister for the environment whom nobody can name. [...] It is not a problem that can be put off for a few decades. It is here and now. It is already making extreme events [...] more likely. Its losses are already there and often mourned—on drab landscapes where the glaciers have died and on reefs bleached of their coral colours. Delay means that mankind will suffer more harm

2 Ibidem, p. 10
3 Ibidem, p. 11

and face a vastly more costly scramble to make up for lost time»[4].

Slowly things are starting to change: in almost every country there are now political parties whose main policies and objectives revolve around climate change, the Green Parties, and civil society has started to mobilise to pressure governments and international policymakers to develop and pursue real actions on climate change.

Since climate change has become such a central topic, the literature on this issue has proliferated in the last years. First, every few years the Intergovernmental Panel on Climate Change (IPCC) releases its reports summarising the main scientific finds on climate change[5]. In addition, there are many specific climate change journals, approaching the subject both from the scientific perspective and from the socio-economic one, such as the the International Journal of Climate Change - Impacts and Responses[6], the International Journal of Climate Change Strategies and Management[7], the Climate Dynamics journal[8], the Nature Climate Change journal[9], the Energy and Climate Change journal[10], the Climate Policy journal[11] and the Climate Change Economics journal[12], amongst many others.

Nowadays there are also many comprehensive books available to the general public whose aim is to give a complete overview on climate change, covering the scientific aspects as well as the political and socio-economic ones[13].

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4 *The climate issue*, in The Economist, vol. 38, 2019, p. 11

5 Official IPCC website, https://www.ipcc.ch/ (last visited on 11th, February 2020)

6 The Climate Change - Impacts and Responses journal Official website, https://on-climate.com/journal (last visited on 11th, February 2020)

7 The International Journal of Climate Change Strategies and Management Official website, https://www.emerald.com/insight/publication/issn/1756-8692 (last visited on 11th, February 2020)

8 The Climate Dynamics journal Official website, https://www.springer.com/journal/382 (last visited on 11th, February 2020)

9 The Nature Climate Change journal Official website, https://www.nature.com/nclimate/ (last visited on 11th, February 2020)

10 The Energy and Climate Change journal Official website, https://www.journals.elsevier.com/energy-and-climate-change (last visited on 11th, February 2020)

11 The Climate Policy journal Official website, https://www.tandfonline.com/loi/tcpo20 (last visited on 11th, February 2020)

12 The Climate Change Economics journal Official website, https://www.worldscientific.com/worldscinet/cce (last visited on 11th, February 2020)

13 See amongst many others: Stefano Caserini, Il clima è (già) cambiato, Edizioni Ambiente, Milano, 2016; James R. Flynn, *Senza alibi: il cambiamento climatico, impedire la catastrofe*, Torino, Bollati Boringhieri, 2015; Cartei Gian Franco, *Cambiamento climatico e sviluppo sostenibile*, Torino, Giappichelli, 2013; Anthony Giddens, *La politica del cambiamento climatico*, Il Saggiatore, Milano, 2015; Andrian Giorgio [et al.], *Etica, ambiente, sviluppo: la comunità internazionale per una nuova etica dell'ambiente*, Napoli, Edizioni scientifiche italiane, 2001; Amitav Gosh, *La grande cecità: il cambiamento climatico e l'impensabile*, Vicenza, Pozza, 2017; Alessandro Lanza, *Il cambiamento climatico*, Bologna, Il Mulino, 2000; George Marshall, *Don't Even Think About It - Why Our Brains Are*

The two main solutions to climate change are mitigation and adaptation. Adaptation is the development of strategies to cope with the effects of climate change and reduce States' vulnerability to them. They are mainly national policies but international cooperation is also important especially to give financial and technical support to less developed or poor countries. Mitigation involves the reduction of GHG emissions in the atmosphere. This requires for each State to implement national policies to curb its own emissions, but mitigation strategies and objectives need to be agreed upon and implemented by the international community as a whole and through strong international cooperation. While adaptation main goal is to reduce the negative impacts of climate change to individual communities by enhancing single States' ability to respond, mitigation represents the only way to effectively stop or at least slow climate change and global warming. For this reason in this dissertation I have chosen to analyse mitigation policies implemented by South Korea. I have selected this country because it is one of the biggest greenhouse gases emitters, with emissions levels equivalent to those of developed countries, which means strong mitigation policies could highly contribute to a global decrease in GHG levels. Also, Korea plays an important role in international relations: even though its emissions levels put the country among developed nations, it is officially classified as a developing country. This in-between status gives Korea the opportunity to play a bridging role between these two groups.

The dissertation will comprise of three chapters. The first chapter will function as a sort of introduction on climate change and South Korea. In the first part of the chapter I will focus on the issue of climate change. First, I will present a few facts about climate change: what it is, its causes and consequences. Next, I will present the two main solutions to this problem, which as said above are mitigation and adaptation, in what they differ from one another and what each one entails. Then, since this thesis is about mitigation policies in South Korea I am going to concentrate on this climate change solution, with the presentation of some of the most important policies implemented globally. Finally, I will

Wired to Ignore Climate Change, Bloomsbury USA, 2015; Grammenos Mastrojeni, Antonello Pasini, *Effetto Serra, effetto guerra*, Chiarelettere editore, Milano, 2017; Mirco Migliavacca, Luca Rigamonti, *Cambiamenti climatici: un approccio interdisciplinare per capire un pianeta in trasformazione*, Il Mulino, Bologna, 2010; Daniele Pernigotti, *Con l'acqua alla gola*, Giunti, Firenze, 2015; Bianca Salvatore, *Cambia il clima cambia il mondo: l'accordo globale di Parigi spiegato dai protagonisti*, Roma, Ministero dell'Ambiente e della Tutela del Territorio e del Mare, 2016; David Wallace-Wells, *The Uninhabitable Earth - Life After Warming*, Tim Duggan Books, 2019

analyse briefly the main steps in international cooperation on climate, from the slow acceptance of climate change as a serious and urgent threat by the international community to the two main achievements of climate change multilateral negotiations, the Kyoto Protocol and the Paris Agreement. In the second part of the chapter I will focus more closely on South Korea. First, I will make a brief general introduction on the Republic of South Korea, outlining its geographical as well as socio-economical structure. Then I will outline Korea's participation and role in international cooperation efforts. In the last two paragraphs of Chapter One I will focus on internal climate actors in South Korea and give a short overview of the Republic of Korea's adaptation strategies, respectively.

In Chapter Two I will focus on GHG reduction efforts in South Korea. Firstly, I am going to examine and present the policies designed and developed by South Korea in order to comply with the objectives set by the Paris Agreement and reduce GHG emissions to counter global warming. Secondly, I will analyse the results of these policies to see if the efforts made by the Republic of Korea are sufficient or if the Korean Government has to up its game in the fight to climate change. This will be achieved by studying the reports and data collected by three online websites whose aim is to monitor progress in the fight against climate change: Climate Action Tracker, Climate Transparency and Climate Change Performance Index. Even though Korea has been dealing with climate change issues for many years now, I have chosen to analyse its policies and projects starting mainly from the year 2016, when Korea had ratified the Paris Agreement.

The last chapter, Chapter Three, will focus on reduction policies in energy production, Korea's biggest emitting sector. First I will give a short overview on renewable sources of energy. Then I will present the Republic of Korea's main national strategies to improve their energy sector. Since, as I will explain in the second chapter, one of the main energy sources available to Korea is nuclear power, I will dedicate a paragraph to the issue of radioactive waste management and related policies implemented by South Korea. Finally, since South Korea is extremely reliant on imports of energy, I will briefly talk about its energy diplomacy efforts.

Chapter One

An introduction to climate change and the climate change fight in South Korea

On today's international scene, one of the most important and pressing issue is the fight against climate change and global warming. Nevertheless there is still some confusion about what is climate change, its causes and consequences and what can be done to stop this phenomenon from worsening. Therefore, the first part of this chapter will be an introduction on the issue of climate change. First, I will present a few facts about climate change: what it is, its causes and consequences. Next, I will explain which are the two solutions to this problem, mitigation and adaptation, and in what they differ from one another. Then, since this thesis is about mitigation policies in South Korea I am going to concentrate more on this climate change solution, with the presentation of some of the most important policies implemented globally. Finally, I will analyse briefly the main steps in international cooperation on climate, from the slow acceptance of climate change as a serious and urgent threat by the international community to the two main achievements of climate change multilateral negotiations, the Kyoto Protocol and the Paris Agreement. In the second part of the chapter I will focus more closely on South Korea. First, I will make a brief general introduction on the Republic of South Korea. Then I will outline Korea's participation and role in international cooperation efforts. The last two paragraphs will focus on internal climate actors in South Korea and a small introduction on Korean adaptation strategies, respectively.

1.1 Climate Change

What is climate change? First of all, we have to be careful to not confuse climate with weather. When talking about climate, we are referring to the average weather conditions over a long period of time[14]; it follows that climate change is any change in the climate, lasting for several decades or longer, including changes in temperature, rainfall or wind

14 World Meteorological Organization, *Climate*, https://public.wmo.int/en/our-mandate/climate (last visited on 3rd, February 2020)

patterns[15]. Weather, instead refers to the state of the atmosphere at a particular place during a short period of time[16].

The Earth's climate has changed constantly throughout history. In fact, «just in the last 650,000 years there have been seven cycles of glacial advance and retreat, with the abrupt end of the last ice age about 11,700 years ago marking the beginning of the modern climate era. Most of these climate changes are attributed to very small variations in Earth's orbit that change the amount of solar energy our planet receives[17]». If, as we have just seen, climate changes are a natural and cyclical occurrence, why is the international scientific community so worried about this phenomenon? The answer is twofold. Today's change in the climate is increasingly alarming, first, because it is happening at an unprecedented speed and, second, because scientific evidence suggests that its high intensity and speed are caused by human activity, in particular by an enormous increase in greenhouse gases (GHG) emissions in the last decades. To give a sense of this, about half of the anthropogenic[18] CO2 emissions between 1750 and 2011, which have been significantly higher than in the past, have occurred in the last 40 years alone[19].

The scientific evidence that human activities are causing today's fast climate change can be found in the IPCC reports. The Intergovernmental Panel on Climate Change (IPCC)[20] was created in 1988 by the World Metereological Organization (WMO) and the United Nations Environment Programme (UNEP), with the goal of providing governments at all levels with scientific information that they can use to develop climate policies. IPCC reports are also a key input into international climate change negotiations. Participation in the IPCC is open to all members of the United Nations and the WMO; the IPCC currently has 197 members. The IPCC presents regular assessment reports to provide a comprehensive summary of what is known about the drivers of climate change, its impacts and future risks, and how adaptation and mitigation can reduce those risks. The IPCC has three Working Groups, one on The Physical Science Basis of Climate Change, one on Climate

15 What is climate change and what can we do about it?, https://www.climatecouncil.org.au/resources/what-is-climate-change-what-can-we-do/ (last visited on 3rd, February 2020)

16 Weather, Encyclopaedia Britannica, https://www.britannica.com/science/weather (last visited on 3rd, February 2020)

17 Climate change: how do we know?, National Aeronautics and Space Administration, https://climate.nasa.gov/evidence/ (last visited on 3rd, February 2020)

18 The term anthropogenic designates an effect or object resulting from human activity.

19 What is climate change and what can we do about it?, https://www.climatecouncil.org.au/resources/what-is-climate-change-what-can-we-do/ (last visited on 3rd, February 2020)

20 Official IPCC website: https://www.ipcc.ch/ (last visited on 3rd, February 2020)

Change Impacts, Adaptation and Vulnerability and one on Mitigation of Climate Change. Alongside these Working Groups operates a Task Force on National Greenhouse Gas Inventories[21]. In its first report, published in 1990, the IPCC formulated hypotheses on possible effects of human activity on the climate. Subsequently, in the third report of 2001, on the basis of the data collected, human responsibility for climate change was no longer considered only a hypothesis but a "very probable" phenomenon. Finally, the IPCC fourth report of 2007 states that climate change is underway and is due to human activity with a degree of probability between 90% and 99%[22].

1.1.1 Causes of climate change

As explained in the previous paragraph, today's climate change is caused by a strong increase in GHG emissions in the last five decades deriving from human activity. The situation, though, is more complex, so to better understand what causes climate change and the impact of human activity on it, we have to take a step back. Naturally, a certain amount of gases, known as greenhouse gases, is released in the atmosphere; for example carbon dioxide (CO2) is released by plants or decaying organic matter. These gases serve as a trap: they let some of the sun's heat in through the Earth's atmosphere but prevent it from escaping. This phenomenon, known as greenhouse effect, keeps the planet warm enough for life to exist[23].

The main greenhouse gases are: carbon dioxide (CO2), which can be released either through natural processes or through human activities such as deforestation, land use changes, and burning fossil fuels; methane (CH4), which also can be produced both through natural sources and human activities, including the decomposition of wastes in landfills, agriculture, and especially rice cultivation, as well as ruminant digestion and manure management associated with domestic livestock; nitrous oxide (N2O), produced by soil cultivation practices, especially the use of commercial and organic fertilizers, fossil fuel combustion, nitric acid production, and biomass burning; finally, chlorofluorocarbons (CFCs), synthetic compounds entirely of industrial origin[24].

21 *About the IPCC*, https://www.ipcc.ch/about/ (last visited on 3rd, February 2020)
22 Nespor Stefano, *La lunga marcia per un accordo globale sul clima: dal protocollo di Kyoto all'accordo di Parigi*, in Rivista Trimestrale di Diritto Pubblico, n. 1, anno 66 (2016)
23 *What is climate change and what can we do about it?*, https://www.climatecouncil.org.au/resources/what-is-climate-change-what-can-we-do/ (last visited on 3rd, February 2020)
24 National Aeronautics and Space Administration, *The causes of climate change*,

Since the Industrial Revolution in the mid to late 1700s, greenhouse gases have started to built up in the atmosphere, trapping more heat than usual close to the Earth's surface. This was due mainly to the practice of digging up and burning coal, oil and gas, as well as scaling up agriculture and tree-clearing (deforestation), and increasing waste (landfill). As more greenhouse gases are added to the Earth's atmosphere, more of the sun's heat is trapped and this causes the Earth's average temperatures to rise[25]. Total GHG emissions have continued to increase since 1970 despite a growing number of climate change mitigation policies and the increase in GHG emissions was higher and faster in the two decades of the 2000s[26].

1.1.2 Consequences of climate change

Another aspect of climate change we need to consider are its consequences. As explained in the above paragraph, the first and more direct consequence of an increase in GHG emissions, is global warming, which means that, on average, Earth will become warmer. This, in turn, will have a series of natural and socio-economic consequences. First, I will present the main natural consequences of climate change and global warming. Global warming will probably change the intensity of evaporation and precipitation patterns, with some regions becoming wetter and others dryer[27]. A stronger greenhouse effect will increase the warmth of oceans and partially melt glaciers and other ice, increasing sea levels. Also, ocean water will expand if it warms, contributing further to the sea level rise, which can change coastal habitats through erosion or sediment deposits and possibly damage some coastal features which play an important role in protecting human settlements from flooding[28].

Climate change and global warming could also have negative impacts on water supply and quality. First, climate change could alter the stratification of water bodies, affecting the supply of oxygen and nutrients which in turn affects fish growth and viability. Then,

https://climate.nasa.gov/causes/ (last visited on 3rd, February 2020)

25 *What is climate change and what can we do about it?*, https://www.climatecouncil.org.au/resources/what-is-climate-change-what-can-we-do/ (last visited on 3rd, February 2020)

26 IPCC, *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Geneva, Switzerland, p.4

27 *The causes of climate change*, National Aeronautics and Space Administration, https://climate.nasa.gov/causes/ (last visited on 3rd, February 2020)

28 *Environmental and social consequences of climate change*, https://www.unpri.org/academic-research/environmental-and-social-consequences-of-climate-change/3028.article (last visited on 3rd, February 2020)

climate change may lead to a change in rainfall patterns, and indirectly impact the use of fertilisers in agriculture, which in turn could lead to higher water pollution. In addition, climate change could lead to a reduction in water supply. This could lead to more water pollution and, combined with an increase in global demand for water will have an impact on the ability of aquatic ecosystems to maintain and replenish[29].

Global warming will also change soil moisture levels, which in turn could impact food production, water supply and quality, and use of land for tourism and leisure. In addition, all components of soil are considered to be at risk from climate change, reducing the ability of ecosystems to function. Changes in the global temperatures could lead to an increased risk from pests, diseases and invasive non-native species, because many species are climate sensitive, and also because generally warmer winters provide a more conducive environment for non-native species and pathogens[30].

Since species distribution is often associated with a particular range of climate parameters, climate change is likely to shift their preferred habitat either geographically or in terms of size. Some species may not be able to find an available and suitable new habitat, leaving them vulnerable to extinction. Also, Changing climates can impact migration patterns, which could in turn affect breeding patterns and their success. In turn, this reduces biodiversity and potentially the resilience of local ecosystems. Finally, higher temperatures and reduced soil moisture, will lead to greater wildfire risk. This can result in habitat destruction and species extinction, as well as increased soil erosion and water pollution[31].

Alongside these natural impacts, climate change also has consequences on human societies and their structure. First, climate change could negatively affect people's health. As said above, changes in climate could result in an increase in pests and diseases or cause changes in water, air, food, ecosystems and infrastructure, which would in turn cause illnesses, disability and even death[32]. In fact, «The World Health Organization reports that the rising temperatures and variable precipitation due to climate change that has occurred since the 1970s claimed over 140.000 deaths. Globally, weather-related natural disasters result in over 60. 000 deaths every year, mainly in developing countries[33]».

29 Ibidem
30 Ibidem
31 Ibidem
32 Social Impacts, Climate Action Network, https://climateactionnetwork.ca/issues/impacts-and-adaptation/learning-cente/global-impacts/social-impacts/ (last visited on 3rd, February 2020)
33 Ibidem

Climate change also affects the food system. Global warming and increased frequency of extreme weather events put severe pressure on food availability, stability, access and use[34]. Furthermore, «availability of agricultural products is affected by climate change through impacts on crop yields, crop pests, diseases, soil fertility and soil water-holding properties»[35].

Most importantly, as seen above, climate change will have high impacts on water supply and quality:

> as water stress increases, we will likely experience much more unstable global food production along with decreased biodiversity, and damaged ecosystems. Record droughts in recent years in places like China, Australia, Brazil, and Kenya as well as floods in Pakistan, Australia, and Columbia, have already made drastic imprints on food production and in turn, global food prices. This, consequently, is expected to create both internal and external social conflicts around the globe due to a limited supply, and increased competition over water resources.
>
> By 2050, more than a billion people in the Asian region (Central, South, East and South-East Asia) are expected to be affected from freshwater shortages due to climate change. Additionally, a great number of people between 75 million and 250 million in the African region are projected to be exposed to increased water stress due to climate change[36].

Different groups will face different challenges, with some people facing greater challenges than others, and have different abilities to cope with climate change impacts. Climate change will affect more people who live in areas vulnerable to coastal storms, droughts, and sea level rises[37].

People who live in poverty will also have a harder time adapting to climate change, due to their limited financial resources to cope with increasing heat, relocate or evacuate, or

34 Ibidem
35 Ibidem
36 Ibidem
37 United States Environmental Protection Agency, *Climate impacts on society*, https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-society_.html (last visited on 3rd, February 2020)

respond to increases in the cost of food. Other groups more affected by climate change will be older adults, immigrants and young children. Also indigenous people will be negatively affected by climate change. Keeping in mind that each indigenous tribe is different, we can present some common reasons for a higher climate change impact on this group. First, they often live in places most affected by climate change; second, they rely on the surrounding environment and natural resources for food and income. Finally, they often lack access to safe drinking water: climate change is expected to increase health risks associated with water quality problems, such as contamination, and may reduce availability of water, particularly during droughts[38].

Similarly, «some types of professions and industries may face considerable challenges from climate change. Professions that are closely linked to weather and climate, such as outdoor tourism, commerce, and agriculture, will likely be especially affected[39]».

This is true also for geographic regions: expert predict that equatorial Africa and South Asia will be the most affected by the negative effects of climate change. Both are extremely vulnerable due to their geographic position and are highly populated zones, whose economy is still underdeveloped. As a result, they have to bear most of climate change's negative consequences: GDP loss, food insecurity, water scarcity, violent weather, epidemics, and so on[40].

Climate change can also have impacts on geopolitical structures. «The geopolitical risk inherent in climate change comes not from actual changes in weather, sea levels, or resource availability but, rather, from the ability or inability of governments to effectively anticipate and manage the coming changes in ways that preserve or create security and prosperity for their citizens. Countries in which state resources are used to secure the loyalty of the population, oil-rich states like Sudan, South Sudan, and even Nigeria, that are not well integrated into the global economy, and in general, less developed states, are far more likely to experience this type of conflict»[41]. One practical consequence of climate change is population displacement, which may result in humanitarian crises and social tensions. This is notably the case in Bangladesh, a very poor and densely populated

38 Ibidem
39 Ibidem
40 Daily Times, *Geopolitical impacts of climate change*, https://dailytimes.com.pk/435643/geopolitical-impact-of-climate-change/ (last visited on 3rd, February 2020)
41 Luminae Group, *The geopolitics of climate change*, https://www.luminaegroup.com/blog/geopolitics-climate-change (last visited on 3rd, February 2020)

country, extremely exposed to the negative effects of climate change. Also, since climate change will very likely cause a shortage in the global supply of water and a worsening of its quality, existing divergences over the control of the use of water basins might get more serious. In South Asia for example, tensions might arise between India, Pakistan and China over Kashmir, the cornerstone of the Indus river basin, or between India, China and Bangladesh over Ganges and Brahmaputra[42]. Water stress could also lead to the destabilization and eventual near-collapse of a country. One example could be Syria, where , according to experts,

> «water scarcity was an underlying factor in the conflict. After years of flawed agricultural policies, overuse of land and groundwater resources, a sudden removal of fuel subsidies and simultaneous increases in global food prices, several years of severe drought and crop failures prompted a large-scale internal migration to the country's urban centers, which exacerbated the unemployment problem. We need only look to Somalia for another example of what happens when states fail and water becomes so scarce that it's used as a weapon by a nefarious actor. In 2011, Somalia experienced severe regional droughts that have been linked to climate change. During this time, jihadist fundamentalist group al Shabaab shifted away from its traditional guerilla tactics and began controlling the water sources of cities where they could not militarily hold power. In combination with limited access by international aid organizations, al Shabaab's effort to demonstrate their power and presence by controlling resources led to more than a quarter million deaths and hundreds of thousands of newly displaced persons»[43].

The negative consequences of climate change may also compromise economic development, condemning people to poverty. In addition, internal conflicts and wars would result from increased resource scarcity, notably of food and water. This, for example, is what could soon happen in Ethiopia, where the effects of climate change exacerbate

42 Daily Times, *Geopolitical impacts of climate change*, https://dailytimes.com.pk/435643/geopolitical-impact-of-climate-change/ (last visited on 3rd, February 2020)

43 Luminae Group, *The geopolitics of climate change*, https://www.luminaegroup.com/blog/geopolitics-climate-change (last visited on 3rd, February 2020)

economic and ethnic divides[44].

As said above, according to experts the two most impacted regions will be equatorial Africa and South Asia; but climate change's effects would also be felt in the rest of the world.

> «Rising sea levels, increases in the frequency and severity of extreme weather events, and temperature changes invariably place added stress on the very resources that play critical roles in the security and stability of states - water, food, transportation, and energy systems, to name a few. When left unmanaged, disruption to any one of these resources can catalyze population displacement, migration, political unrest, and domestic or regional conflict»[45].

For example, in 2018, «the World Bank predicted that climate change could result in 1.4 million people fleeing their homes in Mexico and Central America during the next three decades»[46].

1.2 Adaptation vs. Mitigation

To face the challenge presented by climate change, individual States and the international community have two different solutions at their disposal: mitigation and adaptation. These two measures are complementary to one another and as such need to be implemented at the same time.

Adaptation is «the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate harm or exploit beneficial opportunities. In natural systems, human intervention may facilitate adjustment to expected climate and its effects»[47]. The goal of adaptation strategies is to help States reduce their vulnerability to the harmful effects of climate change and to harness any potential beneficial opportunity

44 Daily Times, *Geopolitical impacts of climate change*, https://dailytimes.com.pk/435643/geopolitical-impact-of-climate-change/ (last visited on 3rd, February 2020)

45 Luminae Group, *The geopolitics of climate change*, https://www.luminaegroup.com/blog/geopolitics-climate-change (last visited on 3rd, February 2020)

46 Ibidem

47 Noble, I.R., S. Huq, Y.A. Anokhin, J. Carmin, D. Goudou, F.P. Lansigan, B. Osman-Elasha, and A. Villamizar, *2014: Adaptation needs and options, i*n Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, p. 838

associated with climate change[48].

Potential climate adaptation strategies span from the agricultural sector, to the coastal, urban, and to many more. These strategies include, amongst others, building sea walls, elevating infrastructure, retreating from low-lying coastal areas altogether, recycling water and reducing its use to face increasing droughts, using prescribed fires to prevent uncontrollable wildfires and favouring drought-tolerant crops like rice, cowpea and maize[49].

Mitigation, instead, involves reducing the flow of heat-trapping greenhouse gases into the atmosphere, either by reducing GHG emissions or enhancing "sinks" that accumulate and store greenhouse gases (such as oceans, forests and soil). Therefore, the goal of mitigation strategies is to avoid more human interference in the climate[50], and «stabilize greenhouse gas levels in a time frame sufficient to allow ecosystems to adapt naturally to climate change, ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner»[51].

1.2.1 Main mitigation technologies

Since this thesis will focus on mitigation policies implemented by South Korea, I now want to present briefly the main strategies developed and utilized globally[52]. Mitigation technologies can be divided into three general categories: energy efficiency improvements, carbon sequestration and carbon intensity reduction[53]. Energy efficiency techniques are, in turn, divided in supply side efficiency and end-use efficiency. Supply side efficiency is defined as «the ratio of useful energy output (heat, work, electricity, etc...) to primary energy input (energy sources)»[54], whereas end-use efficiency is defined as «the ratio of

48 National Aeronautics and Space Administration, *Responding to climate change*, https://climate.nasa.gov/solutions/adaptation-mitigation/ (last visited on 3rd, February 2020)

49 The Climate Reality Project, *Climate adaptation vs. mitigation: what's the difference and why does it matter*, https://climaterealityproject.org/blog/climate-adaptation-vs-mitigation-why-does-it-matter (last visited on 3rd, February 2020)

50 National Aeronautics and Space Administration, *Responding to climate change*, https://climate.nasa.gov/solutions/adaptation-mitigation/ (last visited on 3rd, February 2020)

51 IPCC, *Summary for Policymakers*, in Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, p. 4

52 For a thorough analysis of costs and benefits in mitigation strategies, see Michael H. Huesemann , *Ocean fertilization and other climate change mitigation strategies: an overview*, in Marine Ecology Progress Series. Vol. 364 (July 29 2008), Inter-Research Science Center

53 Ibidem p. 244

54 Ibidem, p. 244

economic output resulting from energy services (measured as GDP) to useful energy output»[55].

Carbon sequestration is a technique which involves either the capture and secure storage of CO2 emissions in geological formations or deep oceans[56], or the removal of CO2 from the atmosphere by terrestrial or marine photosynthesis and the subsequent, long-term storage of carbon-rich biomass[57]. «Terrestrial carbon sequestration consists of the photosynthetic fixation of atmospheric CO2 by plants and the long term accumulation and storage of biomass. Rates of terrestrial carbon sequestration can be increased by reforestation and by implementing alternative soil management practices. Geological carbon sequestration involves the storage of CO2 in deep underground reservoirs, such as depleted gas and oil fields, non-mineable coal seams, and saline aquifers»[58]. For carbon sequestration in oceans, there are two different strategies: first, the direct disposal of CO2 in deep oceans. This can be achieved via means such as the introduction of liquid CO2 onto a sea-floor depression or in-depth release of CO2 enriched seawater. The other ocean carbon sequestration strategy is the addition of fertilizers to stimulate the growth of phytoplankton, which is then expected to sink to the ocean floor and thus sequester CO2 there[59].

Finally, the third climate mitigation approach involves reducing the carbon intensity of the energy mix. This can be achieved by the decarbonisation of fossil fuels, the increased use of renewable energies (biomass, wind, photovoltaic, solar thermal and hydroelectric) or a greater use of nuclear power[60].

1.2.2 Market-based policies: taxes, subsidies and Emissions Trading Schemes

Alongside the mitigation strategies I have presented in the previous paragraph, a new category of mitigation policies has been developed in recent years: market-based policy instruments. These instruments aim to

> «modify the behaviour of firms and individuals by changing the financial

55 Ibidem, pp. 244-245
56 Also known as Carbon Capture and Storage (CCS)
57 Michael H. Huesemann , *Ocean fertilization and other climate change mitigation strategies: an overview,* p. 245
58 Ibidem, p. 245
59 Ibidem, p. 245
60 Ibidem, p. 246

incentives and disincentives they face and operate by adjusting relative prices or creating markets that did not previously exist. Many countries are deploying market-based instruments to reduce GHG emissions and promote investment in clean energy technology. In particular, a growing number of developing countries have been actively developing market-based mitigation strategies to reduce energy consumption and GHG emissions, as well as jump-start investments in clean and renewable energy»[61].

These market-based mitigation strategies can be divided into three categories: taxes, subsidies, and trading systems. Taxes set a price per unit of pollution, either directly on GHG emissions or on goods or services that are GHG intensive. Subsidies are the opposite of taxes: basically, they are monetary incentives, usually dispensed by public entities (governments, intergovernmental organizations, etc.) to encourage a particular economic action. Tax incentives and preferential loans are examples of subsidies. Finally, Trading Systems (also known as Emissions Trading Systems) set a limit on quantities of pollution or on a specific type of energy, allowing at the same time emitters to buy and sell emission rights, letting the market determine the price rather than setting it directly[62]. Examples include cap-and-trade programs[63], baseline-and-credit emissions trading programs[64], and the use of trading systems to meet energy savings or renewable energy targets[65].

To give an example of a well established Emissions Trading System, I will briefly present the European Union's Emissions Trading System[66]. The EU ETS is the major emissions trading scheme in the world and has served as a model for other countries' ETS. For example, as we will see in Chapter Two, South Korea has designed its own Emission

61 Moarif Sara, Rastogi Namrata Patodia, *Market-based climate mitigation policies in emerging economies*, Center for Climate and Energy Solutions, Arlington, 2012, p. 1

62 Ibidem, p. 1

63 Cap-and-trade is a system for controlling carbon emissions by which an upper limit (cap) is set on the amount a given business or other organization may produce but which allows further capacity to be bought from other organizations that have not used their full allowance.

64 A Baseline and credit scheme is a system by which an emissions intensity is set for emitting activities against a baseline (which can be business as usual or some proportion thereof) and credits are created for activities that achieve emissions intensities below the baseline and activities that have emissions intensities above the baseline have to buy such credits.

65 Moarif Sara, Rastogi Namrata Patodia, *Market-based climate mitigation policies in emerging economies*, p. 1

66 For a complete view on this program, visit the following link: European Commission, *EU Emissions Trading System* (EU ETS), https://ec.europa.eu/clima/policies/ets_en (last visited on 3rd, February 2020)

Trading Scheme (known as K-ETS), modelled on the European one. The European ETS was created and implemented in 2005 and now accounts for over three-quarters of international carbon trading[67].

How does this Emissions Trading Scheme work? The EU ETS is a cap-and-trade system, so a cap is set on the total amount of certain greenhouse gases that can be emitted by installations covered by the system; this cap is then reduced over time in order to make total emissions fall[68]. Within the cap, «companies receive or buy emission allowances which they can trade with one another as needed and can buy limited amounts of international credits from emission-saving projects around the world. After each year a company must surrender enough allowances to cover all its emissions, otherwise heavy fines are imposed. If a company reduces its emissions, it can keep the spare allowances to cover its future needs or else sell them to another company that is short of allowances»[69]. A carbon price[70] is also set to promote investment in clean, low-carbon technologies.

The EU ETS covers the emissions of carbon dioxide, nitrous oxide and perfluorocarbons (PFCs), from the following sectors: power and heat generation, energy-intensive industries like oil refineries, steel works and production of iron, aluminium, metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids and bulk organic chemicals (like nitric, adipic and glyoxylic acids and glyoxal), and commercial aviation. Participation in the EU ETS is mandatory for companies in these sectors, even though in some sectors only plants above a certain size are included. Also, certain small installations can be excluded if governments put in place fiscal or other measures that will cut their emissions by an equivalent amount[71].

1.3 The long road to global climate change agreements

The goal of every climate mitigation policy is to reduce the amount of greenhouse gases in the atmosphere, either through reductions in GHG emissions or technologies to capture and

67 Ibidem
68 Ibidem
69 Ibidem
70 A carbon price is a cost applied to carbon pollution to encourage polluters to reduce the amount of greenhouse gas they emit into the atmosphere
71 European Commission, *EU Emissions Trading System (EU ETS)*, https://ec.europa.eu/clima/policies/ets_en (last visited on 3rd, February 2020)

storage them. This means that, even though each State has to develop and implement its own mitigation strategies internally, the international community has to cooperate in order to set common goals and to help struggling States (usually developing countries) to achieve them. Thus, I am now going to outline the main steps in international cooperation efforts and negotiations regarding climate change.

1.3.1 Recognizing the importance of climate change issues

Environmental issues in general, and the climate change issue in particular, were not a major concern of the international community in the years following the creation of the United Nations Organization. Particularly, during its first 23 years, action on these issues was limited, carried out mainly by the World Meteorological Organization (WMO)[72]. The little attention paid to these issues was mostly motivated by preoccupations about the adequacy of known natural resources to provide for the economic development of UN members, mostly "underdeveloped countries", as they were then termed. For example, the 1949 UN Scientific Conference on the conservation and utilization of resources was the first UN body to address issues relating to the environment and natural resources[73]. We will have to wait until 1968 for environmental issues to receive serious attention by any major UN organ. In that year, The Economic and Social Council included for the first time those issues in its agenda as a specific item and decided to hold the first United Nations Conference on the Human Environment[74]. This Conference, held in Stockholm in June 1972 and known as the First Earth Summit, adopted a declaration that set out principles for the preservation and enhancement of the human environment, and an action plan containing recommendations for international environmental action. In a specific section on the identification and control of pollutants of broad international significance, the issue of climate change was raised for the first time, alongside a warning to countries to be mindful of activities that could lead to climate change[75].

At the Stockholm Conference was established the Governing Council of the United Nations Environment Programme (UNEP), with its secretariat in Nairobi, Kenya, the

72 UN Chronicle, *From Stockholm to Kyoto: a brief history of climate change*, https://www.un.org/en/chronicle/article/stockholm-kyoto-brief-history-climate-change (last visited on 3rd, February 2020)
73 Ibidem
74 Ibidem
75 Ibidem

Environment Fund and the Environment Coordination Board. Again, the central preoccupation of these bodies was not climate change itself but water resources, marine mammals, renewable energy resources, desertification, forests, environmental legal framework and the issue of environment and development[76].

Over the next 20 years, as part of efforts to implement the 1972 decisions, concern for the atmosphere and global climate slowly gained international attention and prompted concrete action. For example, in 1979 the UNEP Governing Council asked its Executive Director to monitor and evaluate the long-range transport of air pollutants[77]. In the same year, the first international instrument on climate was adopted: the Convention on Long-Range Trans-boundary Air Pollution. Again, in 1980 the UNEP, worried about the damage to the ozone layer, recommended measures to limit the production and use of chlorofluorocarbons F-11 and F-12, which subsequently led to the negotiation and adoption in 1985 of the Vienna Convention for the Protection of the Ozone Layer and the conclusion of a Protocol to the 1979 Trans-boundary Air Pollution Convention. In the meantime, evidence that climate change was due to air pollution was beginning to emerge thanks to the phenomena of acid rain in Europe and North America[78].

1.3.2 The first steps in climate change international cooperation

In 1988, global warming and the depletion of the ozone layer became increasingly prominent in the international public debate and political agenda. First, the Intergovernmental Panel on Climate Change (IPCC), was established and met for the first time in November[79]. Then, the UN General Assembly identified climate change as a specific and urgent issue and through its resolution on the protection of global climate for present and future generations of mankind, it asked WMO and UNEP to initiate a comprehensive review and make recommendations on climate change, including possible response strategies to delay, limit or mitigate the impact of climate change. The following year, the Helsinki Declaration on the Protection of the Ozone Layer was adopted in May and the Montreal Protocol on Substances that Deplete the Ozone Layer entered into force[80]. Efforts to raise awareness of the effects of climate change were further advanced at the

76 Ibidem
77 Ibidem
78 Ibidem
79 See above for a description of the IPCC and its functioning
80 Ibidem

second World Climate Conference, held in November 1990 in which climate change was described as a global problem of unique character for which a global response was required. The 1990 Conference also called for negotiations to begin on a framework convention on climate change without further delay. As a result, the UN General Assembly decided to convene the United Nations Conference on Environment and Development in 1992 in Rio de Janeiro[81]. At the 1992 Earth Summit, the United Nations Framework Convention on Climate Change (UNFCCC)[82] was opened for signature. The Convention, which entered into force in March 1994, and has been ratified by 197 States, has as its primary goal the prevention of dangerous human interference with the climate system, by stabilizing greenhouse gas concentrations[83]. The UNFCCC also establishes the convening of annual Conferences of the Parties (COP)[84], with the participation of all member States, to continue international cooperation efforts on climate change.

One important espect of the Convention is the principle of Common but Differentiated Responsibilities (CBDR)[85]. The basis of this principle is that developed countries, which are the source of most past and current greenhouse gas emissions, were expected to do the most to cut emissions on home ground, whereas developing countries would face almost no responsibility, no matter how much GHG emissions they produced[86]. Developed countries, called Annex I parties, are also member of the Organization for Economic Cooperation and Development (OECD) and include also countries with "economies in transition" from Central and Eastern Europe. Annex I countries were expected by the year 2000 to reduce emissions to 1990 levels[87]. Also, they agreed to support climate change activities in developing countries (also known as non-Annex I parties) by providing greater financial support and help them develop new technologies both to mitigate and adapt to

81 Ibidem
82 The Official UNFCCC website: https://unfccc.int/ (last visited on 3rd, February 2020)
83 United Nations Climate Change, *What is the United Nations Framework Convention on Climate Change?*, https://unfccc.int/process-and-meetings/the-convention/what-is-the-united-nations-framework-convention-on-climate-change (last visited on 3rd, February 2020)
84 For more informations on UNFCCC Conferences of the Parties, visit the following link: https://unfccc.int/process/bodies/supreme-bodies/conference-of-the-parties-cop (last visited on 3rd, February 2020)
85 Nespor Stefano, *La lunga marcia per un accordo globale sul clima: dal protocollo di Kyoto all'accordo di Parigi,*
86 Ibidem
87 United Nations Climate Change, *What is the United Nations Framework Convention on Climate Change?*, https://unfccc.int/process-and-meetings/the-convention/what-is-the-united-nations-framework-convention-on-climate-change (last visited on 3rd, February 2020)

climate change[88]. The CBDR principle was then better defined in the Berlin Mandate, adopted at the first Conference of the Parties in 2005[89].

1.3.3 From he Kyoto Protocol to the Paris Agreement

The first real milestone in international climate change action was the adoption at the end of the COP-3, held in Japan in December 1997, of the Kyoto Protocol to the UNFCCC. The Protocol aimed to reduce developed countries' overall GHG emissions by at least 5 per cent below the 1990 levels in the commitment period of 2008 to 2012. The Protocol opened for signature in March 1998 and came into force on 16 February 2005[90]. The Kyoto Protocol is based on the principles and provisions of the UNFCCC and follows its annex-based structure. This means that, following the principle of "common but differentiated responsibility, it only binds developed countries, placing a heavier burden on them[91]. «One important element of the Kyoto Protocol was the establishment of flexible market mechanisms, which are based on the trade of emissions permits. Under the Protocol, countries must meet their targets primarily through national measures. However, the Protocol also offers them an additional means to meet their targets by way of market-based mechanisms»[92]. The Kyoto Protocol was later subjected to a series of criticisms. One of these regarded the principle of CBDR which put the burden of GHG emissions reductions only on industrialized states: the obligations on these countries, although very heavy, would have been insufficient to achieve the objective of the Convention to stabilize climate change: Annex I Parties represented less than 50% of global emissions. To complicate things, came the decision of the United States, the world's largest producer of greenhouse gas emissions, not to ratify the Protocol, which meant that the countries bound by the Protocol only represent 14% of total emissions[93].

Even before the Kyoto Protocol went into force, negotiations were started to lay the foundations for the regime following the end of the commitment period in 2012.

88 Ibidem

89 UN Chronicle, *From Stockholm to Kyoto: a brief history of climate change*, https://www.un.org/en/chronicle/article/stockholm-kyoto-brief-history-climate-change (last visited on 3rd, February 2020)

90 Ibidem

91 United Nations Climate Change, *What is the Kyoto Protocol?*, https://unfccc.int/kyoto_protocol (last visited on 3rd, February 2020)

92 Ibidem

93 Nespor Stefano, *La lunga marcia per un accordo globale sul clima: dal protocollo di Kyoto all'accordo di Parigi*

Furthermore, it was clear that the condition to any succefful international cooperation effort would have involved reviewing the principle of CBDR and reintroducing a common responsibility of all States, albeit differentiated on the basis of each country's capabilities[94].

The next step in international negotiations was the adoprtion, during the COP-15 in 2009 of the Copenhagen Accord. This document only had political value, which means it wasn't legally binding. Nonetheless, It is important to mention it since for the first time all the Parties declared that they wanted to comply, albeit on the basis of equity and in a context of sustainable development, with the data resulting from scientific researches on climate change and, in particular, with the conclusions reached in the 4th report of the IPCC.[95]

Unfortunately, a UNEP report noted that, based on the plans presented at Copenhagen, emissions in 2020 would have been higher than the 2°C increase in global temperature target set by the IPCC 4th report. Therefore, it would have been necessary for each state to set more ambitious targets[96].

As a result, during the COP-16 of 2010, held in Cancùn in 2010, the political commitments of the Copenhagen Accord were formally adopted. Furthermore, for the first time, ample space was also devoted to adaptation processes, which, although envisaged by the Framework Convention, had always taken on a secondary role in international negotiations[97].

In 2011, during the COP-17, held in South Africa, the Durban Platform was adopted. This document prescribed that the entire international community would move forward in the negotiation for a global agreement on climate change with legal effect. This commitment was also confirmed in the COP-18 held in Qatar in 2012, which also outlined a timetable for the adoption of a universal climate agreement by 2015, and in the COP-20 in Lima of 2014. The Durban Platform also specified that the Agreement would have had to set more ambitious targets for each State than those previously indicated and deal with the following points: mitigation, adaptation, financial aspects, development and transfer of technologies, transparency and support in the implementation of commitments[98].

After the Kyoto Protocol, the second milestone in international cooperation has been the COP-21 in Paris, in which the Paris Agreement was adopted. Due to the great expectations

94 Ibidem
95 Ibidem
96 Ibidem
97 Ibidem
98 Ibidem

of the interntaional community, the Paris Conference saw the participation of 15 heads of state and over 20,000 representatives of the 195 member States. The conference ended with the publication of two separate documents: the Paris COP Decision and the Paris Agreement. Only the Agreement is a legally binding document. The combination of these two documents has been called the Paris Outcome[99]. The Paris Agreement entered into force on 4th November 2016[100]. Its central aim is to:

> «Strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. Additionally, the agreement aims to strengthen the ability of countries to deal with the impacts of climate change. To reach these ambitious goals, appropriate financial flows, a new technology framework and an enhanced capacity building framework will be put in place, thus supporting action by developing countries and the most vulnerable countries, in line with their own national objectives. The Agreement also provides for enhanced transparency of action and support through a more robust transparency framework»[101].

1.3.4 Using Preferential Trade Agreements to further international cooperation efforts

As evinced from the brief history of international cooperation presented above, the negotiating process to reach universal climate change agreements is long and difficult. Almost 20 years had passed between the two major international agreements on climate change: the Kyoto Protocol and the Paris Agreement. Also, the Conferences of the Parties that followed the COP-21 have shown disappointing results. In a paper he wrote in 2013, Rafael Leal Arcas, a law professor at the Queen Mary University of London[102], has suggested using Preferential Trade Agreements (PTAs) to carry forwards the international

99 Ibidem

100 United Nations Climate Change, *The Paris Agreement*, https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement (last visited on 3rd, February 2020)

101 Ibidem

102 For his profile, visit the following link: https://www.qmul.ac.uk/law/staff/lealarcas.html (last visited on 3rd, February 2020)

climate agenda. According the Arcas, PTAs have become more prominent in international trade negotiations because of the stagnation of the multilateral system[103]. In this he sees a similarity between international trade negotiations and international climate negotiations: «both have been besieged with institutional difficulties»[104].

Because of the stalemate experienced in recent years by multilateral trade negotiations, countries have found that one solution could be circumventing multilateralism altogether. This has resulted in the proliferation of PTAs, with the aim of moving their trade forward by turning to smaller negotiating fora. This led to the idea of including climate chapters in PTAs and involving major GHG emitters in these agreements in order to move towards reducing greenhouse gases emissions and facilitate the ultimate goal of creating an effective global climate regime[105]. PTAs already contain provisions that are not only about trade; for example, many include investment chapters. In the long-term, the aim would be to multilateralize all the Bilateral and Regional Trade Agreements: this would lead, having previously included climate chapters in PTAs, to the multilateralization of the climate change agenda[106]. Therefore, the idea would not be to completely substitute the top-down approach to climate change mitigation via the UNFCCC framework, but to complement it[107].

It is noteworthy to mention that the introduction of environmental provisions in PTAs is not an entirely new phenomenon. RTAs negotiated in the past, mostly by OECD countries, already include some type of environmental provisions. These provisions, though, revolve mainly around agreeing to cooperate on various matters of environmental protection, but do not contain any praticta l plan or policy, which is what Professor Arcas' idea encompasses[108].

1.4 South Korea

Until now I have concentrated on introducing the subject of climate change. I have

103 Rafael Leal-Arcas, *Climate Change Mitigation from the Bottom Up: Using Preferential Trade Agreements to Promote Climate Change Mitigation*, in Carbon & Climate Law Review, Vol. 7, No. 1 (2013), Lexxion Verlagsgesellschaft mbH, p. 34

104Ibidem, p. 35

105Ibidem, p. 35

106Ibidem, p. 36

107Ibidem, p. 36

108Ibidem, p. 37

explained what climate change is, its causes and consequences. I have explained the difference between adaptation and mitigation, and briefly presented the main climate mitigation techniques and strategies used globally. Finally, I have given an overview of the international negotiation process with regards to climate change. Now I want to focus on the country whose policies I have chosen to analyse: South Korea. First I will give a general overview of the country, presenting information on its geography, climate, population, economy and GHG emissions. Next, I will give a brief presentation on Korea's international effort against climate change. Then I will describe the main climate actors in Korea and how they interact with each other. Finally, I will dedicate a paragraph to the presentation of the main aspects of South Korea's adaptation strategy.

1.4.1 A general overview

Geographically, the Republic of Korea is a mountainous country. South Korea is a peninsula; in the North it borders with North Korea and it shares the Yellow Sea with the People's Republic of China to the West, and the East Sea and Korean Straits with Japan to the East and South, respectively[109]. The average altitude above sea level is 482 meters; the highlands above 1,000 meters are mostly located in the northern region of the peninsula, whereas the southern region consists of mountains of 500 meters or less[110]. The river flows are extremely irregular, sometimes being very strong, which causes large amounts of sand and gravel to be transported from mountains to downstream areas or estuaries. More than 60% of annual precipitations is discharged as floods due to heavy rains in summer. Korea's total land area is 100,364 km² and consists of 63,834 km² of forest lands cover (63.6%), 11,282 km² of paddy fields (11.2%), 7,611 km² of dry fields (7.6%), and 3,251 km² of roads (3.2%)[111].

The Republic of Korea is located in the four-season mid-latitude temperate climate zone. Winters are cold and dry due to continental high atmospheric pressure, and summers are generally hot and humid because of the North Pacific anticyclone. During spring and autumn, the migratory anticyclones often provide relatively clear skies and dry conditions[112].

109 The Government of the Republic of Korea, *Fourth National Communication of the Republic of Korea Under the United Nations Framework Convention on Climate Change*, 2019, p. 14
110 Ibidem, p. 14
111 Ibidem, p. 14
112 Ibidem, p. 15

As of 2018, the ROK's population was approximately 51,607,000[113]. The average annual population growth rate in the ROK was about 3% in the 1960s; however, due to the successive implementation of measures to suppress population growth the rate gradually decreased and dropped sharply. For example, in 2005 it was less than 0.5%. In terms of age, the median age increased from 31.8 in 2000 to 42.6 in 2018 and life expectancy increased (with slight variation in the rates of males and females) from 75.6 years in 1999 to 80.6 years in 2009. The proportion of the population aged 65 years or older also rose from 7.2% in 2000 to 11.0% in 2010, which shows that the Korean population is aging at a very rapid pace[114].

South Korea's economic growth rate remained high at more than 7% before the foreign currency crisis in 1998, but started to decrease from the 2000s. Since 2008, the ROK's growth rate has fallen to around 3% due to the global economic recession caused by the global financial crisis[115]. The Republic of Korea has promoted export-led economic growth since its initial development, and as a result, both exports, with their need for raw materials and capital goods, and imports, have expanded rapidly. Alongside exports, the manufacturing sector also play a significant role in the national economy. For example, as of 2017, dependence on exports stood at 37.5%, while the share of the manufacturing sector accounted for 30.4% of the nominal GDP in 2017[116].

The impact of climate change in South Korea is felt in a wide range of sectors including weather, ecology, environment, and water resources; regionally, it occurs in different patterns. It is very probable that future climate change trends will also occur regionally in different patterns. There is considerable fluctuation in the average annual precipitation in Korea, but recent trends show an increase in their amounts. This increase is attributed to the lengthening summer season where the largest share of precipitation occurs. The annual precipitation tends to decrease as the latitude increases, so the precipitation on the southern coast is the highest in the ROK[117].

South Korea is internationally recognized as one the main GHG emitters. In 2016, the national GHG emissions were 694.1 million tons CO2eq. and net emissions including sinks

113 Ibidem, p. 16
114 Ibidem, p. 16
115 Ibidem, p. 16
116 Ibidem, p. 16
117 Ibidem, p. 17

were 649.6 million tons CO2eq[118]. Total emissions in 2016 were 0.2% higher than in 2015 because of increased emissions from road transport (4.4 million tons, by 4.9%), residential (1.8 million tons, by 6.0%), chemicals (1.4 million tons, by 3.8%), and petroleum refining (1.3 million tons, by 8.1%) sectors. It was analyzed that the increased emissions in road transport were due to increased fuel consumption caused by the increase in the number of registered vehicles (by 3.9%)[119].

1.4.2 South Korea's International cooperation on climate change

On the international scene, South Korea has always played an active role, both as a member of the international community and as a sort of bridge between developed and developing countries. The latter is due to the Republic of Korea's

> «unique position under the UNFCCC. Along with Mexico, it has been classified as a non-Annex I party, despite its membership of the Organisation for Economic Co-operation and Development (OECD) since the Kyoto Protocol was adopted in 1997. As such, South Korea stands at the line that divides developing and developed countries. However, it has experienced difficulties in securing developing country status: its annual CO2 emissions from fossil fuel combustion by 2010 were the fourth highest of the OECD countries and the seventh highest overall in the world. Furthermore, the growth rate of its GHG emissions since 2000 is the highest in the OECD»[120].

South Korea has acceded to a number of leading international conventions on the protection of the environment and the fight against climate change. Through these conventions it has also taken part in the discussion of, and response to, climate and environmental issues such as the protection of biodiversity, the sustainable use of resources, the protection of marine ecosystems, the international management of chemical and toxic substances. Examples of this include the Korean ratification of the Paris Agreement, and its participation in a series of conferences, including the UNFCCC annual

118 Ibidem, p. 4
119 Ibidem, p. 4
120 Sun-Jin Yun, Dowan Ku, Jin-Yi Han, Climate policy networks in South Korea: alliances and conflicts, in Climate Policy, volume 14, issue 12, 2014, p. 284

Conferences of the Parties, such as the Forum of Ministers and Environment Authorities of Asia Pacific, the Conference of the Parties of the UN Convention to Combat Desertification and the OECD Green Growth, Sustainable Development Forum and the 4th United Nations Environment Assembly[121]. Alongside its participation in international conferences, during the years South Korea has also taken part in various multilateral climate projects. I will now present three of them as examples.

First, the Korean government has been a leading force in the establishment of the Global Green Growth Institute (GGGI)[122]. This institute, established in 2012 as an international organization, counts as of October 2019, 36 members, with Ecuador, Angola and the Organization of Eastern Caribbean States (OECS) being the latest to have joined. The GGGI's main goal is to assist developing countries in addressing climate change, establishing and implementing green growth strategies and capacity building[123]. In June 2013, the Organization for Economic Cooperation and Development - Development Assistance Committee (OECD-DAC) granted the Official Development Assistance (ODA) eligibility status to the Institute. In December of the same year, the GGGI received United Nations General Assembly observer status. The Korean government is also actively engaged in GGGI meetings and consultations with the Secretariat as well as member States to support GGGI's efforts to improve its project implementation and governance[124].

In October 2018, South Korea attended the first P4G Summit in Copenhagen. Partnering for Green Growth and the Global Goals 2030 (P4G)[125] is a global initiative launched by Denmark in 2017 in order to promote private-public partnerships in 5 key areas (water, energy, circular economy, cities and food and agriculture) to achieve the UN sustainable development goals (SDGs) and to accelerate the implementation of the Paris Agreement[126]. Then, in 2019 was announced that Korea will host the 2020 P4G Summit. The Korean government is also trying to promote public-private partnerships with P4G partner

121 Ministry of Foreign Affairs, *Multilateral Environmental Diplomacy*, http://www.mofa.go.kr/eng/wpge/m_5654/contents.do (last visited on 3rd, February 2020)

122 The official website of the Global Green Growth Institute: https://gggi.org/ (last visited on 3rd, February 2020)

123 Ministry of Foreign Affairs, *Multilateral Environmental Diplomacy*, http://www.mofa.go.kr/eng/wpge/m_5654/contents.do (last visited on 3rd, February 2020)

124 Ibidem

125 The official website of Partnering for Green Growth and the Global Goals 2030: https://p4gpartnerships.org/ (last visited on 3rd, February 2020)

126 Ministry of Foreign Affairs, *Multilateral Environmental Diplomacy*, http://www.mofa.go.kr/eng/wpge/m_5654/contents.do (last visited on 3rd, February 2020)

countries in order to establish a professional network, create business models and disseminate best practices[127].

Finally, the Korean Ministry of Foreign Affairs launched in 2016 the "Green Round Table" to discuss ways to strengthen cooperation between international organizations and domestic agencies related to climate change environment and green economy[128].

South Korea has also taken part in a series of international cooperation projects on the issues of environment protection and climate change such as green economy, environmental industry, technology development and environment improvement assistance amongst others, with many countries. In Asia Korea has cooperated with China, Japan, Mongolia, Vietnam, Cambodia, Indonesia and the Association of South East Asian Nations (ASEAN). In the Middle East, the Republic of South Korea has cooperated with Iran, Azerbaijan, Kuwait, Israel, The United Arab Emirates, Kazakhstan, Uzbekistan and Turkmenistan. Even though to a lesser degree, Korea has started cooperation projects also with African countries, including Tunisia. In America Korea has established relations with Canada and the United States as well as with some Latin American countries, including Ecuador, Peru, Chile, Costa Rica, Columbia and Mexico. In Europe Korean cooperation has been active bilaterally with individual European countries, including the United Kingdom, France, Denmark, the Netherlands, Germany, Hungary, the Czech Republic, Russia and Norway, as well as with the European Union[129]. A noteworthy example of cooperation between South Korea and the European Union on climate change is The EU-KOREA Climate Action (EU-KOR) Project[130]. This project is a unique tool to connect climate actors within and between Europe and Korea. The overall objective of the EU-KOR project is to enhance climate action and the transition to a low carbon resilient economy in Korea and the European Union[131]. The EU-KOREA Climate Action has two main purposes. First, to establish networks, dialogue and exchange of best practices in the climate change and low carbon development fields between EU-KOR non-state actors. Second, to facilitate the establishment between EU-KOR stakeholder of cooperation efforts

127 Ibidem
128 Ibidem
129 *Bilateral and Multilateral Environmental Coopeartion*, http://eng.me.go.kr/eng/web/index.do?menuId=422 (last visited 4th, December 2020)
130 The official EU-Korea Climate Action Project website: https://www.climateaction-korea.eu/ (last visited on 3rd, February 2020)
131 *The EU-Korea Climate Action project in a nutshell*, https://www.climateaction-korea.eu/about/ (last visited on 3rd, February 2020)

in climate actions. The actors targeted include nationwide and sub-national non-state stakeholders and stakeholder networks, government authorities below the central level, NGOs and CSOs[132], industry, business intermediaries and businesses, academia, and media, amongst others[133].

1.4.3 Korea's internal actors in the climate change fight

A study conducted by three Korean researchers analyses which are the main internal actors in South Korea on climate change issues and how they interact. First, we can divide internal actors into three main categories: governmental organizations (GOs), business organisations (BOs) and civil society organisations.

The results of this study show that GOs are placed at the centre of policy networks. The study also shows that Korea's most active GOs are the Ministry of Knowledge and Economy (MKE), the Ministry of Environment (ME) and the Presidential Committee on Green Growth (PCGG)[134]. The Ministry of Knowledge and Economy is in charge of industrial and energy policies and during the years has implemented policies aimed at boosting economic growth through an abundant and cheap energy supply. The Ministry of Environment has taken a proactive position on climate change by promoting relatively active policies. The Presidential Committee on Green Growth, established in 2009, formulates policies for green growth and coordinates the related branches of the government[135]. The study shows a mutual collaboration both within different governmental organizations and between GOs and business organisations, as well as strong collaboration within the business sector. Examples of major Korean business organizations are: the Business Institute for Sustainable Development and the Korea Business Council for Sustainable Development. Furthermore, the study outlines that, despite some connections with GOs, the civil organisation have tended to create networks mainly within the civil sector[136]. Korea has many civil society organisations, but some major examples can be cited: the Green Korea United, the Korean Federation of Environmental Movements,

132 Civil Society Organizations
133 *The EU-Korea Climate Action project in a nutshell*, https://www.climateaction-korea.eu/about/ (last visited on 3rd, February 2020)
134 Sun-Jin Yun, Dowan Ku, Jin-Yi Han, *Climate policy networks in South Korea: alliances and conflicts*, in Climate Policy, volume 14, issue 12, 2014, p.288
135 Ibidem, p, 288
136 Ibidem, p. 290

Environmental Justice, Open Hands, the Green Future Campaign, the Korea Mountain Preservation League, the Korea NGOs Energy Network and the Climate Change Center.
The results show that the government was also the major actor in South Korean climate policy decision making. GOs were identified most frequently as collaborating organizations as well as sources of important information and reliable advice. In particular, the ME, MKE, and PCGG were key climate policy actors[137].

1.4.4 Brief overview of South Korea's Adaptation strategy

To reduce the impact of climate change, South Korea has made it mandatory to establish and implement measures to adapt to climate change at national and local government levels in accordance with the Framework Act on Low Carbon, Green Growth and its Enforcement Decree, which contain provisions on the establishment and implementation of adaptation measures to mitigate climate change impact or respond to health and natural disasters. At present, the Republic of South Korea aims at minimising the impacts of climate change and protect the safety and property of its people by establishing a National Climate Change Adaptation General Plan, alongside National Climate Change Adaptation Measures and a Climate Change Response Master Plan. In addition, at the local level, Metropolitan Cities are establishing their own measures to adapt to climate change and implementing detailed plans, like the Daegu International Heat Wave Response Forum and the Campaign of Ten Million Trees[138].

1.5 Conclusions

In the first part of this chapter i have focused on the issue of climate change. I have explained that changes in climate have occured cyclically throughout time. Today's climate change, though, represent a threat because it is happening at an incredibly fast rate, due to an increase in GHG emissions in the atmosphere caused by human activity. Greenhouse gases emissions are an integral part of natural processes: they produce the greenhouse effect, which is the reason Earth is warm enough for life to exist. The higher levels of GHG emissions in the last decades have caused more heat to remain trapped inside the

137 Ibidem, p. 295
138 The Government of the Republic of Korea, *Fourth National Communication of the Republic of Korea Under the United Nations Framework Convention on Climate Change*, p. 72

atmosphere, causing average temperatures to rapidly rise. This phenomenon is called global warming. This is starting to have a wide variety of negative consequences that will worsen other time, including melting of ice, increase in sea levels, worsening of water quality and a decrease in its supply, loss of biodiversity and damage to ecosystems. These in turn will affect human society: scarcity of food and water, and an increase in the latter's pollution, coupled with a potential increase in diseases, will cause coflicts and alter the geopoltical balances and create more crises. Different groups of people will be affected in different ways. The more vulnerable will be poor people, older adults, young children, immigrants and indigenous people. States have two different solutions to face this threat: adaptation and mitigation. Adaptation strategies aim to reduce vulnerability to natural events, whereas mitigation strategies try to stop the advancement of global warming and climate change by reducing GHG levels in the atmosphere, by both reducing emissions and capturing greenhouse gases already present and storing them in underground sinks.

After this introduction on climate change I have briefly outlined the main steps in international cooperation efforts. The two main achievements were the Kyoto Protocol of 1997 and the Paris Agreement in 2015. This brief history of multilateral climate negotiations shows that, even though the international community is willing to cooperate to face this threat, there are still obstacles to a full global cooperation on this issue and, at least for now, individual interests, usually of an economic nature, take precedence in each State's international strategy.

Finally, in the second part of the chapter I have focused on South Korea. After a brief general overview of the country's geography and socio-economic structure, I have presented Korea's international effort to fight climate change. In doing so, I have outlined Korea's unique position on the international stage: although it is recognized as a non-Annex I party under the UNFCCC regime, which is to say a developing country, Korea is also a member of the OECD and its GHG emissions level are the same as developed country. Because of this in-between position, South Korea can play a bridging role between developing and develoed countries.

I them moved on to describe Korea's main internal actor on climate change. They can be divided into three categories: governmental organisations, business organisations and civil society organisations. I presented a study which analysed these three goups and how they interact. The results showed that in Korea the government and its organs are the main

climate change actors and climate change policies drivers. They interact mainly within themsemlves and with business organisations. This is due to the fact that civil society organisations, though they sometimes have contacts with the other two gruops, tend to mostly interact within themselves. This shows that Korea has a very centralized structure when it comes to its climate policies, with the government taking the lead. Thus, other groups, in particular civil society organizations are mostly not included in the national effort to mitigate clmate change.

Chapter Two

Mitigation and Greenhouse Gas Emission Reduction Policies

When talking about climate change and the fight against it, one of the main problems that immediately comes to mind is global warming, which studies suggest is caused by high levels of GHG (greenhouse gasses) emissions, produced mainly by human activity.

It follows that arguably the most important goal of any global and local mitigation policy should be the reduction of the amount of GHG emissions produced.

The 2015 Paris Agreement on Climate Change[139] states that nations must aim «to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius[140]».

In this chapter, firstly, I am going to examine and present the policies designed and developed by South Korea in order to comply with the objectives set by the Paris Agreement and reduce GHG emissions to counter global warming.

Secondly, we will analyse the results of these policies to see if the efforts made by the Republic of Korea are sufficient or if the Korean Government has to up his game in the fight to climate change. This will be achieved by studying the reports and data collected by three online websites whose aim is to monitor progress in the fight against climate change: Climate Action Tracker[141], Climate Transparency[142] and Climate Change Performance Index[143].

Korea has been dealing with climate change issues for many years now, but I have chosen to analyse its policies and projects starting mainly from the year 2016, having chosen the 2015 Paris Agreement as a turning point in the fight against climate change.

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139 To download the full text of the Paris Agreement visit: https://unfccc.int/process/conferences/pastconferences/paris-climate-change-conference-november-2015/paris-agreement (last visited January 4th, 2020)

140 UNFCCC website, *The Paris Agreement*, https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement (last visited January 4th, 2020)

141 For more informations visit the Climate Action Tracker official website: https://climateactiontracker.org/ (last visited January 4th, 2020)

142 For more information visit the Climate Transparency official website: https://www.climate-transparency.org/ (last visited January 4th, 2020)

143 For more information visit the Climate Change Performance official website: https://www.climate-change-performance-index.org/ (last visited January 4th, 2020)

2.1 The Nationally Determined Contributions (NDCs)

At the international level, South Korea released in 2016 its first National Determined Contribution. Nationally Determined Contributions (NDCs, also known as Intended Nationally Determined Contributions, INDCs) are a part of the Paris Agreement and a key component in the achievement of its long-term goals. As reported on the United Nations Framework Convention on Climate Change website:

> «NDCs embody efforts by each country to reduce national emissions and adapt to the impacts of climate change. The Paris Agreement (Article 4, paragraph 2) requires each Party to prepare, communicate and maintain successive nationally determined contributions (NDCs) that it intends to achieve. Parties shall pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions. […] Together, these climate actions determine whether the world achieves the long-term goals of the Paris Agreement and to reach global peaking of greenhouse gas (GHG) emissions as soon as possible and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHGs in the second half of this century. It is understood that the peaking of emissions will take longer for developing country Parties, and that emission reductions are undertaken on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty, which are critical development priorities for many developing countries»[144].

NDCs are submitted every five years to the UNFCCC secretariat and are recorded in the NDC registry which is publicly available and maintained by the secretariat[145].
The Republic of South Korea has submitted its first NDC on November 3rd, 2016. The new year of submission will be 2020 so as of now the 2016 document is also Korea's only NDC. At the time of writing only one country, the Marshall Islands, had already submitted

144 UNFCCC official website, *Nationally Determined Contributions*, https://unfccc.int/process-and-meetings/the-paris-agreement/nationally-determined-contributions-ndcs#eq-2 (last visited January 4th, 2020)
145 Ibdem

their second NDC.

In its 2016 NDC, South Korea has pledged to reduce it's greenhouse gas emissions by 37% from the BAU[146] level of 850.6 MtCO2eq by 2030 across al economic sectors[147].

Baseline	($MtCO_2eq$) Year: 2020 | 2025 | 2030 BAU: 782.5 | 809.7 | 850.6 The scenario is based on the BAU projection of KEEI-EGMS (the Korea Energy Economics Institute Energy and GHG Modeling System), taking into account projections for key economic variables, including population, GDP, industrial structure and oil price.
Reduction Level	Emission reduction by 37% from the BAU level by 2030
Coverage	Economy-wide
Sectors	Energy, industrial processes and product use, agriculture and waste (A decision on whether to include land use, land-use change and forestry (LULUCF) will be made at a later stage.)
Gases	• Carbon Dioxide (CO_2) • Methane (CH_4) • Nitrous Oxide (N_2O) • Hydrofluorocarbons (HFCs) • Perfluorocarbons (PFCs) • Sulphur hexafluoride (SF_6)
Metric	Global Warming Potential (GWP) values from the IPCC Second Assessment Report (1995) used to calculate CO_2 equivalents
Inventory Methodology	• Consistent with methodologies used in Korea's Biennial Update Report (BUR) submitted in December 2014 • 1996 IPCC Guidelines used in general to calculate greenhouse gas emissions and sinks • 2006 IPCC Guidelines used to calculate greenhouse gas emissions from rice cultivation in agriculture (4C) and other waste (6D)
International Market Mechanism	Korea will partly use carbon credits from international market mechanisms to achieve its 2030 mitigation target, in accordance with relevant rules and standards.
Land Sector	In assessment of mitigation performance, a decision will be made at a later stage on whether to include greenhouse gas emissions and sinks of the land sector as well as the method for doing so.

NDCs explicative table, Intended Nationally Determined Contribution, Submission by the Republic of Korea, pp. 1-2. See footnote 147 for the link to download the full text

146 Business as usual; BAU is often used to refer to the without-policy scenario in a fixed base year

147 Republic of South Korea, *Intended Nationally Determined Contributions*, 2016, p. 1. To download the full text, visit the following link: https://www4.unfccc.int/sites/NDCStaging/Pages/All.aspx (last visited on January 4th, 2020)

After a brief introduction, illustrating the planning process and part of the national legislative effort to fight climate change, the NDC presents the measures planned for each sector.

Regarding the energy sector, the plan was to obligate power generators to supply a portion of electricity from renewable sources and, thus, increasing the production of renewable energy in order to reduce greenhouse gas emissions from fossil fuels. For this purpose the Government showed support for the installation of facilities for the local generation of renewable energy[148].

In the building sector, the Korean government is seeking to manage energy efficiency from the design stage to the operation stage by means such as establishing the Green Building Standards Code and a system for the Performance Evaluation of Eco-friendly Homes[149].

In the transport sector, the Korean government is continuing to expand infrastructure for environment-friendly public transportation, while introducing low-carbon standards for fuel efficiency and emissions produced from automobiles. In order to do so, the government has decided to strengthen the average emission standard from 140 g/km in 2015 to 97 g/km in 2020; South Korea also provides various incentives, including tax reductions for electric and hybrid vehicles in order to promote low-carbon vehicles[150].

While implementing sectoral measures for mitigation, Korea established a domestic measurement, reporting, and verification (MRV) system to monitor businesses with large amounts of greenhouse gas emissions in the industry, power generation, building and transport sectors[151].

The NDC target of a 37% reduction in GHG emissions, South Korea has stated, would be fulfilled despite the fact that Korea's mitigation potential is limited due to its industrial structure. Additionally, the document goes on, given the decreased level of public acceptance following the Fukushima accident, there are now limits to the extent that Korea can make use of nuclear energy, one of the major mitigation measures available to it[152]. This is in part due to the fact that, as some experts have underlined, the natural conditions of South Korea are unfavourable for large-scale renewable energy. «Solar and wind power plants require large-scale sites, but South Korea has limited land space with lots of

148 Ibidem, p. 3
149 Ibidem, p. 3
150 Ibidem, p. 3
151 Ibidem, p. 3
152 Ibidem, p. 4

construction regulations. In addition, wind velocity is slow where the ocean is shallow, and in coastal areas, the locals may oppose the construction pointing out possible harm done to the landscape and fish resources»[153].

2.2 National GHG Reduction Plans

2.2.1 The First Basic Plan for Climate Change

In the same year, the South Korean Government has launched on the national scene what it has called its "First Basic Plan for Climate Change Response". The plan, which was released on 6 December 2016 after the approval by the National Green Growth Committee, incorporates the goal stated in the Republic of Korea's NDC of reducing emissions by 37% by 2030. As reported

> «The First Basic Plan is the first comprehensive policy that has medium and long-term strategies and specific action plans to combat climate change. The Basic Plan puts the focus for emission reduction on new market-and-technology-oriented efforts. It seeks to encourage the role and contribution of the private sector in reducing emissions. The Basic Plan also promotes the active participation of the public in climate change efforts. It establishes mechanisms that facilitate collaboration in combatting climate change between the central and local governments and public and private sectors. The Basic Plan provides consulting services to small and medium enterprises regarding the adoption of energy-saving technologies.
>
> The Plan further states that the South Korean government will invest more in the development and utilization of clean energy across the country. It calls for the government and public enterprises to cooperate in doubling the investment of R&D for utilizing clean energy. Private enterprises will concentrate on their own businesses and the government will focus on R&D for the public sector. The Basic Plan states that the prime investment fields for clean energy technology will be in renewable energy, efficiency improvements, demand management,

153 Energgiewende Team, *South Korea's move towards renewables*, https://energytransition.org/2018/06/south-koreas-move-towards-renewable-energy/ (last visited on January 4th, 2020)

carbon capture, use and storage, nuclear energy, and thermoelectric power transmission and distribution»[154].

2.2.2 The First Greenhouse Gas Reduction Roadmap

In 2014 the Republic of Korea released a Greenhouse Gas Reduction Roadmap to promote policies to achieve the 2009 goal of reducing the emissions level by 30% from BAU in the year 2020, thus reducing national emissions from 776 million tons to 543 million tons[155].

According to the Roadmap, reduction rates would be 34.3% (from the 2020 BAU of 99.58 million tons to 34.18 million) for the transportation sector; 26.9% (from 167.63 million tons to 34.18 million) for the building sector; 26.7% for the power generation sector; 25.0% (from 78.86 million tons to 4,46 million) for the public sector; 18.5% (from 439 million tons to 81.3 million) for the industry sector, 12.3% for the waste sector and 5.2% in agriculture and fisheries, with industry and power generation making up more than 50% in terms of reduction proportion[156].

In the Greenhouse Reduction Roadmap, the Korean government then outlined four different strategies of implementation. The first strategy was to minimise the industrial burden by operating a market-friendly reduction system. This was to be achieved by combining the emissions trading scheme[157] and energy demand management with the maintenance of free allocation of emission allowances for sensitive industries, such as petrochemical and cement manufacturing, which have high production costs and are highly dependent on exports. Also, technical and financial support was to be provided to small and medium businesses to help enhance their reduction capacity[158].

The second strategy centred on technological and scientific research. This strategy was two-fold: on the one hand, a R&D strategy road map would be created to help enhance the climate change responsiveness of the scientific and technological sector. On the other hand, core technologies in the fields of Carbon Capture and Storage (CCS)[159] and non-CO2

154 Climate Scorecard, *First Basic Plan for Climate Change Response*, https://www.climatescorecard.org/2017/05/south-korea-emission-reduction-policy/ (last visited on January 4th, 2020)

155 Ministry of Environment, *Greenhouse Gas Reduction Roadmap*, http://eng.me.go.kr/eng/web/index.do?menuId=212, (last visited on December 3rd, 2019)

156 Ibidem

157 For an explanation of Emissions Trading Systems, see Chapter One

158 Ministry of Environment, *Greenhouse Gas Reduction Roadmap*, http://eng.me.go.kr/eng/web/index.do?menuId=212, (last visited on December 3rd, 2019)

159 Carbon Capture and Storage is a technology that can capture up to 90% of the carbon dioxide (CO2)

reduction technology would be developed, alongside the development of technologies for energy efficiency and their distribution to heavily emitting businesses.

The third strategy was to use reduction as a means to create new jobs and new markets, for example by training greenhouse gas verifiers and other professionals to manage greenhouse gas emissions calculations and reports. This strategy also included the distribution and construction of new renewable energy facilities, greenhouse gas reduction facilities and high-efficiency equipments.

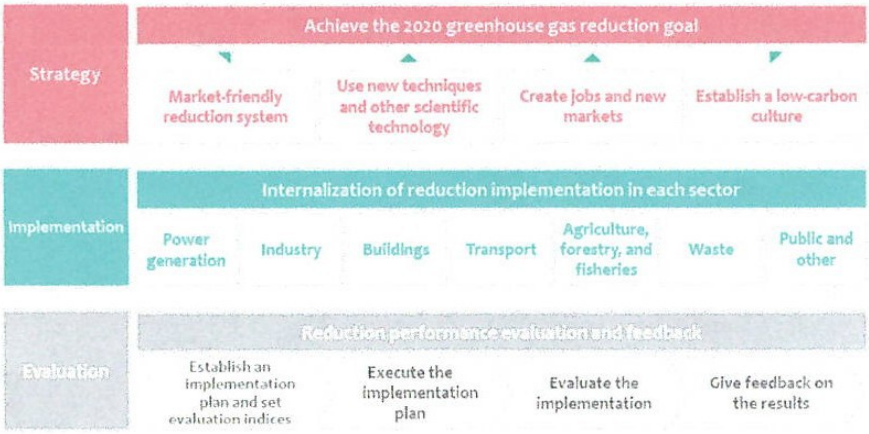
The fourth and final strategy was to promote emissions reduction policies to the public via an organized publicity campaign. This campaign would also have been used to promote eco-friendly actions by the public, like strategies to save cooling and heating energy, use more green transportation methods and reduce strand-by power waste[160].

Finally, The Greenhouse Gas Reduction Roadmap presented a brief implementation plan for each sector. In the industry sector key reduction methods included replacing heavy oil in the oil refining, steel and petrochemical industries with Liquefied Natural Gas (LNG), breaking down N2O in petrochemicals, recovering SF6 from electronic industries to reduce process emissions and increasing co-generation and waste heat recovery facilities. In the transport section, key reduction measures were to reorganize the traffic system with a focus on public transportation, eco-friendly cars, bicycles, walking, and other eco-friendly traffic policies, such as increased public transportation, improved fuel efficiency, distribution of green cars and other green technologies. In the building sector key reduction methods included enhancing energy reduction performances and improving the efficiency of heating and cooling facilities. In the public sector certain green programs, such as the public sector Greenhouse Gas Target Management System would have been put in place. Proposed key reduction methods included improving the efficiency of the heating and cooling facilities, lighting equipment and office appliances. The agriculture, forestry and fisheries sector would have managed sowing and livestock emission sources and improved the efficiency of energy use. The plan for the waste sector was to reduce waste and recycle and convert waste into energy; and, finally, the power generation sector would have improved the

emissions produced from the use of fossil fuels in electricity generation and industrial processes, preventing the carbon dioxide from entering the atmosphere. For more informations on this technology, visit the CCS Association website at the following link: http://www.ccsassociation.org/what-is-ccs/ (last visited on January 4th, 2020)

160 Ministry of Environment, *Greenhouse Gas Reduction Roadmap*, http://eng.me.go.kr/eng/web/index.do?menuId=212, (last visited on December 3rd, 2019)

power supply mix and increased the distribution of new renewable energy as their key reduction measures[161].



National Greenhouse Gas Reduction Implementation Strategy and System, Ministry of Environment. See footnote 155 for the link

2.2.3 The Emissions Trading Scheme and the GHG & Energy Management Target

As mentioned above, part of the Republic of Korea's strategy to cut GHG emissions was to set up an Emissions Trading System (also known as K-ETS), which was launched in January 2015. The Korea Emissions Trading Scheme (K-ETS), designed on the model of the European Union Emissins Trading System[162], caps greenhouse gas (GHG) emissions from participants within the scheme and involves the issuance of a corresponding number of emission allowances, where each allowance represents 1 ton of carbon dioxide equivalent (tCO2eq) permitted to be emitted. Participants must measure their annual emissions and surrender allowances to cover their emission responsibility. Participants that emit less than their allocation can sell their excess allowances, while those who do not have enough allowances to cover their annual emissions need to buy them. This creates the direct economic incentive for emission reduction. At the same time, the cap limits the GHG reductions to target levels[163]. The first step in the Emissions Trading System design is defining its coverage by outlining business sectors and any other categories of emitters that will be included. Once the participating sectors are selected, participation thresholds need

161 Ibidem
162 See Chapter One for more iformation on this program
163 Asian Development Bank, *The Korean Emission Trading Scheme – challenges and emerging opportunities*, p. 12. To access the full text, visit the following link: https://www.adb.org/publications/korea-emissions-trading-scheme (last visited on January 4th, 2020)

to be confirmed to identify emitters that have to comply with the system. Then an emissions cap has to be set: the cap provides an upper limit of the aggregated GHG allowance budget for covered entities[164].

The K-ETS project consists of three subsequent phases. The first and second phase have operated under three-year plans, in the 2015-2017 period and in the 2018-2020 period, respectively; successively, the third phase, which will be implemented from 2021 onward, will mark the beginning of five-year plans. At the beginning of each phase, the government establishes an allocation plan, in which it defines how emission allowances are to be allocated. The allowance allocation is detailed by sector and by business category, which creates the basis for each participant's allocation. Allowances can be either allocated for free or auctioned within the K-ETS[165].

A total of 23 industries were subject to Phase 1[166]. Based on their business conditions and performance, some were given additional allowances or had a portion of allowances cancelled. As of September 2016, a total of 602 companies were designated for allocation of emission allowances. For Phase 1, all emission allowances were allocated for free to entities in order to minimize the economic burden and to ensure the successful implementation of the K-ETS[167]. In Phase I, the overall cap was set at 1,687 million tCO2e. In the first year of Phase I, there were 539,753 allowances distributed among the participating entities. The power generation sector received almost 46% of the total allocation. The energy-intensive industries were also allocated relatively large shares of allowances with iron production receiving 19% of the total, followed by petrochemical industry with 9%, and cement production with 8%. All other sectors received a smaller number of allowances[168]. In Phase 2, the allocation method that granted favour to companies with high facility efficiency have been expanded to induce further technological innovation of companies, and companies that had reduced their GHG emissions by investing in eco-friendly facilities have been granted incentives. In addition, from Phase 2, allocations have been partially auctioned. By supplying allowances to the market through regular auctions, the Republic of Korea was planning to enhance the liquidity and vitality

164 Ibidem, pp. 13-14
165 Ibidem, p. 14
166 The Government of the Republic of Korea, *Second Biennial Update Report of the Republic of Korea Under the United Nations Framework Convention on Climate Change*, 2017, p. 34
167 Ibidem, p. 34
168 Asian Development Bank, *The Korean Emission Trading Scheme*, p. 15

of the K-ETS market[169]. The share of auctioned emissions was set at 3% for Phase II but will increase to over 10% in Phase III[170]. Moreover, the transformation to a low-carbon high-efficiency industrial structure have been stimulated by a financial support system established for the purpose of reinvesting revenues from allowance auctions into the industrial innovation of companies participating in the K-ETS. An integrated platform have been built to provide information about trading volume and price in order to improve information asymmetry among K-ETS market participants and to vitalize the trading market[171].

Another mitigation project worth mentioning is the GHG & Energy Management Target, which has been operating since 2010. This program is operated by the Korean Energy Agency (KEA) which designates companies with large amount of GHG emission and energy consumption as the subject of the target management, then imposes them with reduction targets and verify and keep track of their performance[172].

2.2.4 Greenhouse Gas Reduction Roadmap 2030

In December 2016, Hankyoreh, an independent Korean newspaper established in 1988, reported that following a cabinet meeting on the 6th of the same month the 2014 Greenhouse Gas Reduction Roadmap had been modified, with the planned reduction percentages reduced[173].

The Korean Government, the newspaper reported, had decided on a "basic national roadmap for greenhouse gas reductions by 2030" allocating 219 million tons of necessary domestic greenhouse gas reductions among the 315 million tons to be reduced by 2030 to eight areas, including power generation, industry, and construction[174].

The Roadmap 2030 called for the biggest reduction, of 64.5 million tons, in the power generation sector, which was to be achieved through adoption of low-carbon power sources, management of electricity demand, and higher electricity transmission and supply

169 The Government of the Republic of Korea, *Second Biennial Update Report of the Republic of Korea Under the United Nations Framework Convention on Climate Change*, p. 34
170 Asian Development Bank, *The Korean Emission Trading Scheme*, p. 16
171 The Government of the Republic of Korea, *Second Biennial Update Report of the Republic of Korea Under the United Nations Framework Convention on Climate Change*, p. 34
172 The Korean Energy Agency official website: https://www.energy.or.kr/renew_eng/climate/foundation/scheme.aspx (last visited on January 4th, 2020)
173 Kim Jung-soo, *Greenhouse gas reductions announced, a major step back from last year*, http://english.hani.co.kr/arti/english_edition/e_national/773646.html (last visited on January 4th, 2020)
174 Ibidem

efficiency[175]. The industrial sector, which includes steel, petrochemicals, and 20 other business types, was set to achieve 56.4 million tons of reductions through energy efficiency improvements, gas development through environmentally friendly processes, refrigerant replacement, innovative technologies, and waste resource use[176]. Other absolute greenhouse gas reduction amounts assigned included 35.8 million tons for buildings, 28.2 million tons for new energy industries, 25.9 million tons for transportation, 3.6 million tons for public and other sectors, 3.6 million tons for waste, and one million tons for agriculture and livestock. In terms of percentage reductions assigned compared to BAU values, the biggest cuts were in transportation at 24.6%, followed by waste at 23%, power generation at 19.4%, buildings at 18.1%, and public and other sectors at 17.3%. The lowest reduction percentage assignment was for agriculture and livestock at 4.8%, followed by industry at 11.7%[177].

The new Greenhouse Gas Reduction Roadmap 2030 was presented as a revision of the original 2014 map justified by the need to honour Korea's pledges made that same year in its NDC[178]. However, if we compare the reduction values set by the New Roadmap 2030 with those found in the 2014 Greenhouse Gas Emissions Reduction Roadmap, it is easy to see the new plan sets lower reduction rates in all sectors, with the exception of waste management. Specifically, the Roadmap 2030's reduction rate for the transportation sector of 24.6% is almost ten percentage points lower than the 34.3% defined in 2014 Roadmap; similarly, rates also fell from 26.9% to 18.1% for buildings and from 26.7% to 19.4% for power generation. Only in the case of waste management did the rate increase, nearly doubling from 12.3% to 23%.

The new roadmap also included «plans to develop a "detailed pursuit plan for overseas greenhouse reduction" by 2020 to achieve 96 million tons of reductions, or 11.3% of 2030 greenhouse gas BAU levels, through purchasing of emissions rights via the international market mechanism (IMM) proposed in the Paris Agreement»[179].

175 Ibidem
176 Ibidem
177 Ibidem
178 Ibidem
179 Ibidem

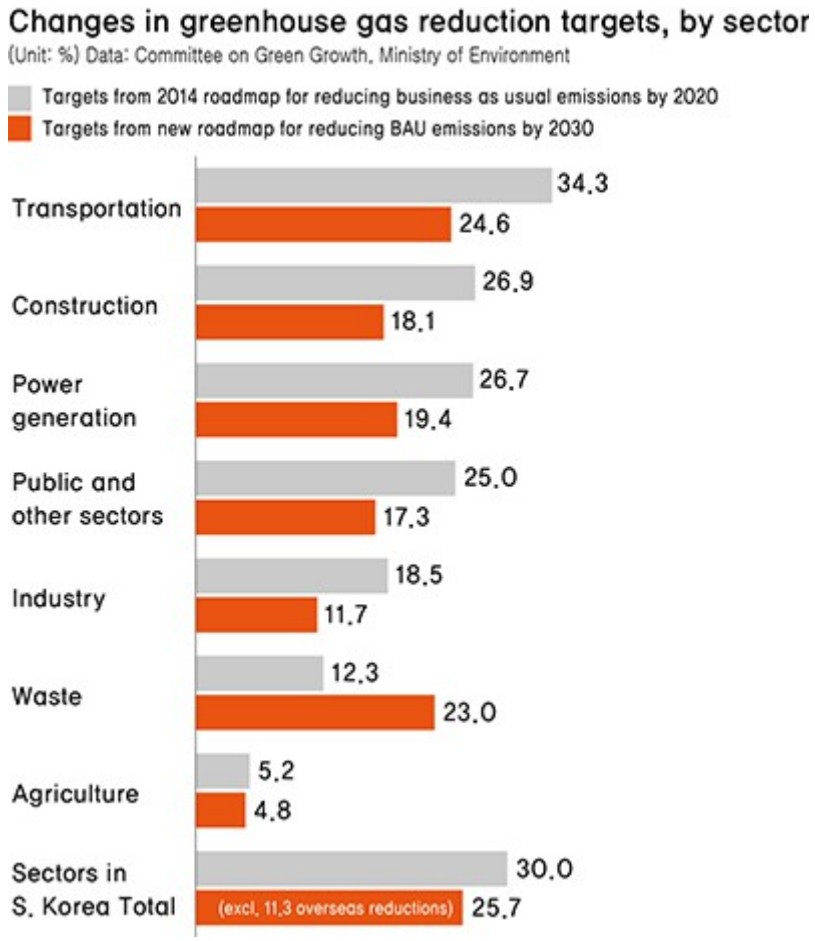


Table on 2016 greenhouse gas reduction targets, by sector, quoted in Kim Jung-soo, Greenhouse gas reductions announced, a major step back from last year, the Korean Times. See footnote 173 for the link to the article

The new Roadmap 2030 also outlined an evaluation system, which consisted of two different methods, to practically implement reduction plans in each sector.

> «The two methods of evaluation are: the evaluation of the implementation of specific strategies (e.g. policies, measures, etc.), and the evaluation of the implementation for the national reduction target. In addition, n order to improve the feasibility of the 2030 Roadmap under the new climate regime, the roadmap will consistently be complemented and revised until 2020 when the second round of NDCs is to be submitted. During this process, the ROK plans to review reduction measures and adjust reduction pathways considering the

changes in circumstances (e.g. emission results, economic conditions, international negotiation outcomes, and revision of related plans). The ROK will also continue to prepare a plan to procure emission allowances by utilizing international carbon markets. Moreover, it plans to present a GHG reduction implementation evaluation system that includes the establishment of a feedback system and the improvement of the national GHG inventory system for GHG reduction performance management. The feedback system includes development of evaluation techniques and an index for major reduction measures; it incorporates GHG reduction performance results into annual work performance evaluations, and budget planning for relevant ministries and agencies»[180].

The 2016 Roadmap also devised seven specific national tasks: transition to low carbon energy policy; cost-effective greenhouse gas reduction through the development of a carbon market; fostering of new industries to cope with climate change and expansion of investments in new technology development; pursue of a climate safe society; promotion of carbon sequestration and resource recycling; strengthening of international cooperation in response to the new climate regime; and establishing the base for nationwide implementation[181].

2.2.5 The 2018 revision of the Greenhouse Gas Reduction Roadmap 2030

In July 2018, following criticism of the original Roadmap 2030, accused of allocating a large portion of emissions reduction to overseas reductions without effectively mapping out specific action plans to this end, the Korean Government released a revised version of the Roadmap.

The revised map plans to reduce overseas carbon emissions by 16 million tons[182], which would be met through a combination of international credits under Article 6 of the Paris Agreement and forest carbon sinks[183], while also pledging to work more stringently on

180 The Government of the Republic of Korea, *Second Biennial Update Report of the Republic of Korea Under the United Nations Framework Convention on Climate Change*, p. 33

181 Asian Development Bank, *The Korean Emission Trading Scheme*, p. 4

182 The Korean Times, *Korea revises roadmap on greenhouse gas*, http://www.koreatimes.co.kr/www/nation/2018/09/371_251430.html

183 A carbon sink is a natural reservoir that stores carbon-containing chemical compounds accumulated over

domestic reductions.

The new 2018 Roadmap also provides indicative national emissions targets at three yearly intervals to give a pathway to the achievement of the 2030 NDC target. It also provides updated targets for the levels of savings that are required of each sector. The principal changes within the Roadmap update are an increased reliance on domestic savings, less use of international credits, and increased savings through forest carbon sinks. Total domestic reductions are now 32.5% of BAU, replacing the previous target of 25.7%[184], while the percentage of reductions covered by international offset credits is now 4.5[185], less than half the one defined by the original 2030 Roadmap of 11.3%. The revised 2030 Roadmap outlines that the largest contribution to domestic emission reductions is expected to come from the industry sector, accounting for 98.6 million tCO2e (20.5% reduction from its BAU level emissions in 2030). However, the greatest proportional emissions reductions are expected to come from the buildings sector with a planned reduction of 64.5 million tons, or 32.7 percent of the BAU levels. Their initial targets of reduction were 56.4 million tons and 35.8 million tons, respectively. In transportation, the reduction target has been upgraded from 25.9 million tons to 30.8 million tons[186].

2.3 Biennial Update Report and National Communication Under the United Nations Framework Convention on Climate Change

On November 30th, 2019 the Republic of Korea submitted its third Biennial Update Report under the United Nations Framework Convention on Climate Change[187] and its fourth National Communication under the United Nations Framework Convention on Climate Change[188]. National Communications (or NCs) are reports compiled by non-Annex I

an indefinite period of time

184 Asian Development Bank, *The Korean Emission Trading Scheme*, p. 4

185 *Republic of Korea increases domestic reduction efforts to achieve 2030 NDC target*, https://icapcarbonaction.com/en/news-archive/562-republic-of-korea-increases-domestic-reduction-efforts-to-achieve-2030-ndc-target (last visited on January 3rd, 2020)

186 Kang Seung-woo, *Korea revises roadmap on greenhouse gas*, The Korean Times, http://www.koreatimes.co.kr/www/nation/2018/09/371_251430.html (last visited on January 4th, 2020)

187 To access all of South Korea's BURs, visit this link: https://unfccc.int/BURs (last visited on January 3rd, 2020)

188 To access all of South Korea's NCs, visit this link: https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/national-communications-and-biennial-update-reports-non-annex-i-parties/national-communication-submissions-from-non-annex-i-parties (last visited on January 3rd, 2020)

Parties which provide information on greenhouse gas (GHG) inventories, measures to mitigate and to facilitate adequate adaptation to climate change, and any other information that the Party considers relevant to the achievement of the objective of the Convention. NCs are submitted every four years. Biennial Update Reports (or BURs) provide an update of the information presented in NCs, in particular on national GHG inventories, mitigation actions, constraints and gaps, including support needed and received. The first BURs should have been submitted by December 2014, consistently with the Party's capabilities or level of support, and every two years thereafter as a summary of their NC or a stand-alone report[189].

Both the Biennial Update Report and the National Communication of 2019 contain a detailed presentation on the climate change effort of South Korea, including both mitigation and adaption policies. In both reports (one being a summary of the other) the chapter on climate mitigation, which is of interest for this dissertation, starts with a thorough explanation of the legal and political background to the climate change fight in the Republic of Korea, including the national plans illustrated above. Then, it moves its focus on practical mitigation projects, like the Korean Emissions Trading Scheme (K-ETS) and the GHG & Energy Management Target, also illustrated before in this chapter. Finally, it illustrates some sector-specific projects and policies, which now I am going to briefly recap here.

In the industrial sector, to reduce the burden of declining industrial competitiveness due to GHG reduction and participate in the global low carbon economy, mitigation policies focus on improving energy efficiency and demand management. This has been done through a combination of legal means (such as the Framework Act on Low Carbon, Green Growth, The Energy Act and The Energy Use Rationalization Act, just to cite a few) and practical projects like the Energy Use Rationalization Master Plan and the creation of Energy Use Rationalization Funds[190].

In the building sector, the focus has been on implementing plans to revitalize green buildings and create strategies on the promotion of energy efficiency, improvement of new buildings, inducement of energy saving practices and green building technology

189 United Nations Climate Change, *National Reports from non-Annex I Parties*, https://unfccc.int/national-reports-from-non-annex-i-parties (last visited on January 3rd, 2020)

190 The Government of the Republic of Korea, *Third Biennial Update Report of the Republic of Korea Under the United Nations Framework Convention on Climate Change*, 2019, pp. 38-39

development. In order to achieve this, South Korea has established various institutional devices to quantitatively evaluate the eco-friendly efficiency of buildings and induce the activation of green buildings like the green building certification system, the building energy efficiency rating certification system and the zero-energy building certification system. The Ministry of Land, Infrastructure and Transport is also operating the building energy management system (BEMS) that monitors and controls the ongoing situation by connecting sensors and measurement equipment to wired and wireless communication networks[191]. Another interesting project is the Green Remodeling Project, which aims to improve energy efficiency through insulation and window replacement and increase the value of existing old buildings by reducing GHG emissions. Finally, the public sector support project and the private sector interest support project provide financial support for construction costs to improve the energy efficiency of existing buildings[192].

The transportation sector aims to transform the existing transportation system into an environment-friendly and energy-saving low carbon transportation system. One of the first steps was to manage the average fuel efficiency of passenger cars sold yearly by Korean manufacturers through means such as tire efficiency rating systems. The road sector focuses on improving the fuel efficiency of internal combustion engine vehicles as well as the distribution of environment-friendly vehicles, which is also promoted by providing subsidies, developing and distributing high efficiency and low-cost hybrid vehicles, improving the performance of electric vehicles, expanding charging facilities, diversifying charging forms, and improving durability and stability of fuel cell electric vehicles. The shipping sector reduces GHG emissions by introducing fuel-efficient linear technology, high-efficiency propellers, gas engines, and electric propulsion systems and supplying environment friendly ships. In addition, to favour public transportation means, transit centres and restricted public transportation district were created, alongside projects to expand urban and metropolitan railway and high-speed railway networks, as well as restricting passenger cars to shift the public towards walking and bicycles use[193].

The Republic of Korea's targets for waste policies include safe waste treatment, recycling waste and resource circulation. In 2018, the Ministry of Environment established the First Resource Circulation Action Plan, which focuses on the efficient use of resources, the

191 Ibidem, pp. 39-40
192 Ibidem, pp. 39-40
193 Ibidem, pp. 41-43

suppression of waste generation and the promotion of circulation. Attention has also been given to reduction and reuse policies such as restrictions of disposable products, regulations against over-packaging and a volume-based waste fee system. The Business Place Waste Reduction System fundamentally suppresses waste generation from the product production stage as well as the product distribution and consumption stage. Also, to help strengthen recycling practices new advanced systems have been introduced, for example waste charges, mandatory separate discharge, extended producer responsibility (EPR), and environmental assessment for recycling waste. Finally, the energy recovery policy focuses on energy recovery of waste resources, such as using organic waste resources as energy and establishing solid refuse fuel (SRF) and environment-friendly energy towns[194].

In the Public Sector the strategy of the Korean Government is, mainly, to implement the GHG & Energy Management Target system for public institutions including central administrative agencies, local governments, public institutions and universities. The Ministry of Environment itself has been providing financial support to the project[195].

The strategy in the Agricultural and Livestock Sector is to develop and implement low carbon farming techniques and energy-saving facilities and expand renewable energy facilities. The plan also includes continued research on livestock manure resources and energy facilities in the sector and pursue measures to reduce GHG caused by the enteric fermentation of ruminants by supplying low-methane feed and high-quality coarse feed. Furthermore, specific GHG reduction projects have been created, such as the agricultural and rural voluntary greenhouse gas reduction project and the low carbon agricultural products certification system[196].

For the Forestry Sector the strategy is to favour reforestation, proceed in the efforts of forest carbon removal and increase domestic forest carbon sinks[197].

194 Ibidem, pp. 43-44
195 Ibidem, pp. 44-45
196 Ibidem, pp. 45-46
197 Ibidem, pp. 46-67

2.4 Independent reports

Now, after having delineated the main national policies and plans to reduce GHG emissions in South Korea, I am going to present the reports created by three different monitoring bodies (Climate Change Performance Index, Climate Action Tracker and Climate Transparency) on the status and effectiveness of South Korea's climate change mitigation policies. In order to give a more complete view I am going to lay out the reports for the years 2018, 2019 and, when available, 2020; this way we will be able to ascertain if the situation has changed, and how, after the implementation of the revised Greenhouse Gas Reduction Roadmap 2030.

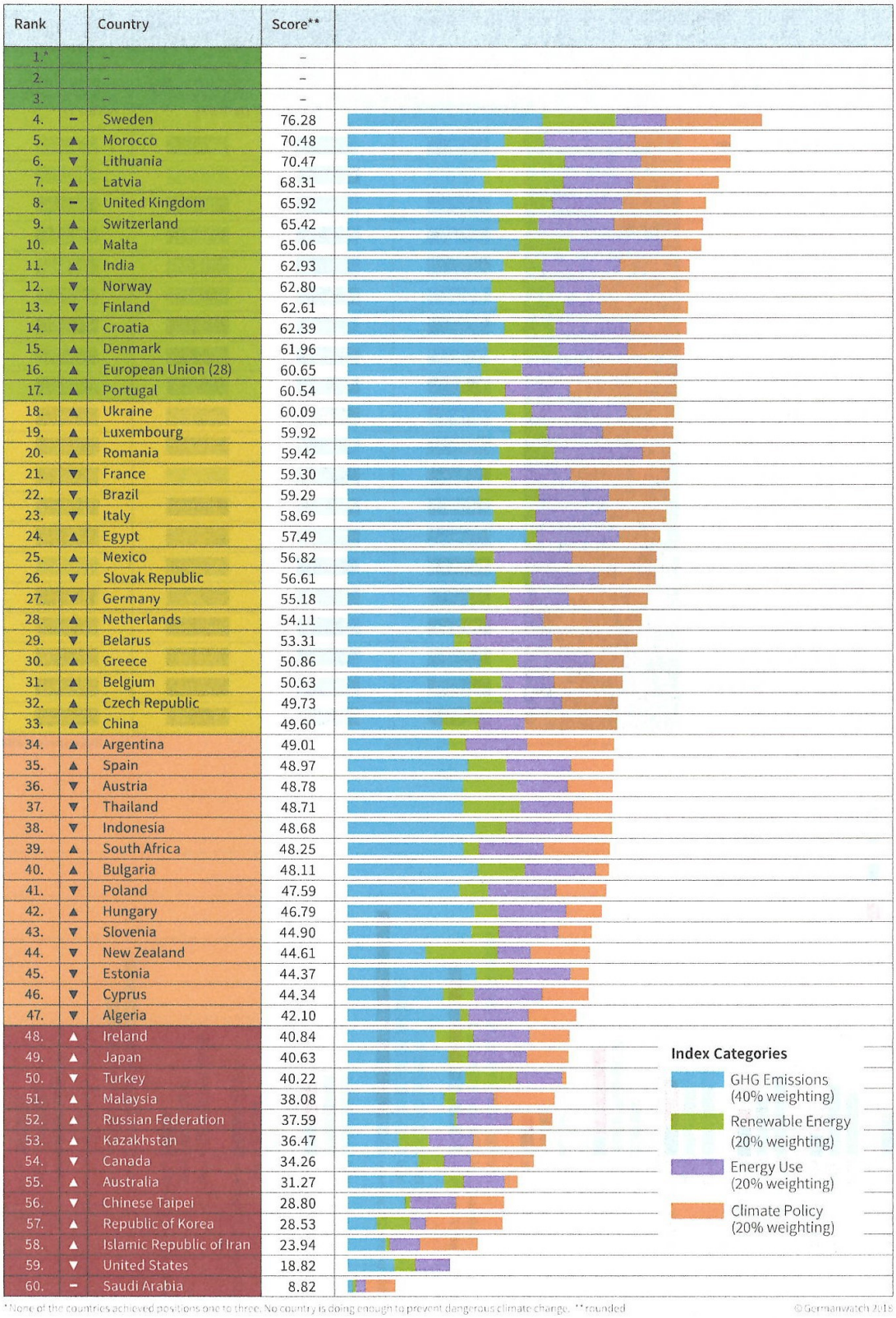
2.4.1 The Climate Change Performance Index

The first report I am going to analyse is the one from the Climate Change Performance Index (CCPI). The CCPI is an independent monitoring tool of countries' climate protection performance. It aims to enhance transparency in international climate politics and enable the comparability of climate protection efforts and progress made by individual countries. The index is published by Germanwatch, the NewClimate Institute and the Climate Action Network. «The review charts the efforts that have been made to avoid dangerous climate change, and also evaluates the various countries' current efforts to implement the Paris Agreement»[198].

For the year 2018, the CCPI report ranks South Korea as 58th out of 60 countries, in the bottom 3, with a comparably very low and severely misaligned performance with regard to a well-below-2°C pathway in the GHG emissions and energy use categories. «Coming from a very low level of renewables in the energy supply, the country's very high rating in the development of renewable energy adds a bright spot to its overall performance. Nonetheless, national experts worry about the increasing installation of coal capacity and coal consumption and criticize their government for its unambitious 2030 emissions reduction target»[199].

198 *The Climate Change Performance Index 2019*, https://www.climate-change-performance-index.org/the-climate-change-performance-index-2019 (last visited on January 4th, 2020)

199 Jan Burck, Franziska Marten, Christoph Bals, Niklas Höhne, Carolin Frisch, Niklas Clement, Kao Szu-Chi, *The Climate Change Performance Index: Results 2018*, Germanwatch, Bonn, p.5. To download the full text, visit: *https://www.climate-change-performance-index.org/the-climate-change-performance-index-2018* (last visited on January 4th, 2020)

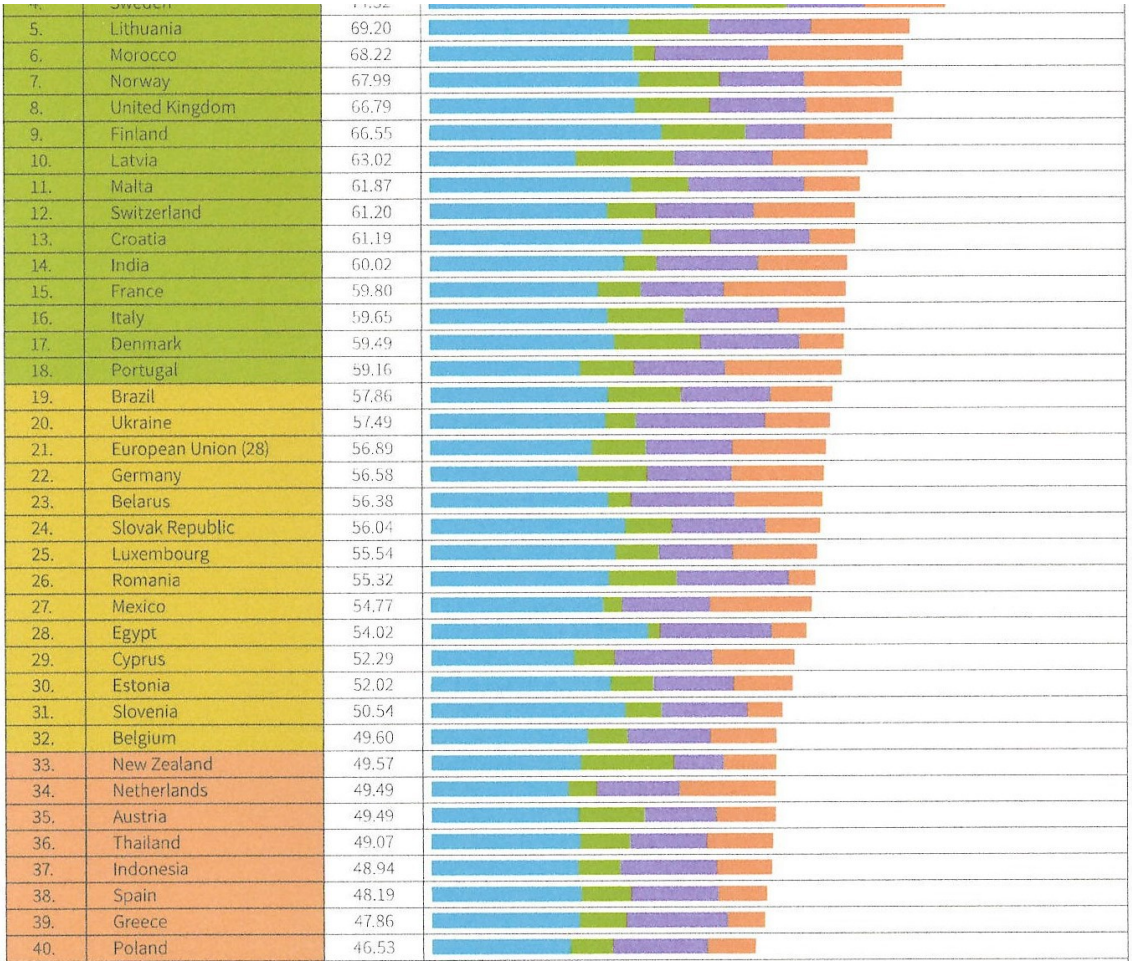


Rank		Country	Score**
1.*		–	–
2.		–	–
3.		–	–
4.	–	Sweden	76.28
5.	▲	Morocco	70.48
6.	▼	Lithuania	70.47
7.	▲	Latvia	68.31
8.	–	United Kingdom	65.92
9.	▲	Switzerland	65.42
10.	▲	Malta	65.06
11.	▲	India	62.93
12.	▼	Norway	62.80
13.	▼	Finland	62.61
14.	▼	Croatia	62.39
15.	▲	Denmark	61.96
16.	▲	European Union (28)	60.65
17.	▲	Portugal	60.54
18.	▲	Ukraine	60.09
19.	▲	Luxembourg	59.92
20.	▲	Romania	59.42
21.	▼	France	59.30
22.	▼	Brazil	59.29
23.	▼	Italy	58.69
24.	▲	Egypt	57.49
25.	▲	Mexico	56.82
26.	▼	Slovak Republic	56.61
27.	▼	Germany	55.18
28.	▲	Netherlands	54.11
29.	▼	Belarus	53.31
30.	▲	Greece	50.86
31.	▲	Belgium	50.63
32.	▲	Czech Republic	49.73
33.	▲	China	49.60
34.	▲	Argentina	49.01
35.	▲	Spain	48.97
36.	▼	Austria	48.78
37.	▼	Thailand	48.71
38.	▼	Indonesia	48.68
39.	▲	South Africa	48.25
40.	▲	Bulgaria	48.11
41.	▼	Poland	47.59
42.	▲	Hungary	46.79
43.	▼	Slovenia	44.90
44.	▼	New Zealand	44.61
45.	▼	Estonia	44.37
46.	▼	Cyprus	44.34
47.	▼	Algeria	42.10
48.	▲	Ireland	40.84
49.	▲	Japan	40.63
50.	▼	Turkey	40.22
51.	▲	Malaysia	38.08
52.	▲	Russian Federation	37.59
53.	▲	Kazakhstan	36.47
54.	▼	Canada	34.26
55.	▲	Australia	31.27
56.	▼	Chinese Taipei	28.80
57.	▲	Republic of Korea	28.53
58.	▲	Islamic Republic of Iran	23.94
59.	▼	United States	18.82
60.	–	Saudi Arabia	8.82

*None of the countries achieved positions one to three. No country is doing enough to prevent dangerous climate change. **rounded

Climate Change Performance Index 2018, p. 7. See footnote 199 for the link to download the full report

The 2019 CCPI report sees a small improvement in Korea's position: this year the Republic of Korea ranks 57th, one position up from the previous year but still among the worst-performing countries. The report states that this is a result of very low ratings in the GHG Emissions and Energy Use category. The Republic of Korea is among the countries with the highest level of per capita emissions and per capita energy use, both of which are increasing. A positive development, however, can be seen in the renewables section with an overall medium rating: although the share of renewables in the energy mix is still very low, the country shows one of the highest growth rates. For its climate policy, the Republic of Korea receives a medium rating[200].



5.	Lithuania	69.20
6.	Morocco	68.22
7.	Norway	67.99
8.	United Kingdom	66.79
9.	Finland	66.55
10.	Latvia	63.02
11.	Malta	61.87
12.	Switzerland	61.20
13.	Croatia	61.19
14.	India	60.02
15.	France	59.80
16.	Italy	59.65
17.	Denmark	59.49
18.	Portugal	59.16
19.	Brazil	57.86
20.	Ukraine	57.49
21.	European Union (28)	56.89
22.	Germany	56.58
23.	Belarus	56.38
24.	Slovak Republic	56.04
25.	Luxembourg	55.54
26.	Romania	55.32
27.	Mexico	54.77
28.	Egypt	54.02
29.	Cyprus	52.29
30.	Estonia	52.02
31.	Slovenia	50.54
32.	Belgium	49.60
33.	New Zealand	49.57
34.	Netherlands	49.49
35.	Austria	49.49
36.	Thailand	49.07
37.	Indonesia	48.94
38.	Spain	48.19
39.	Greece	47.86
40.	Poland	46.53

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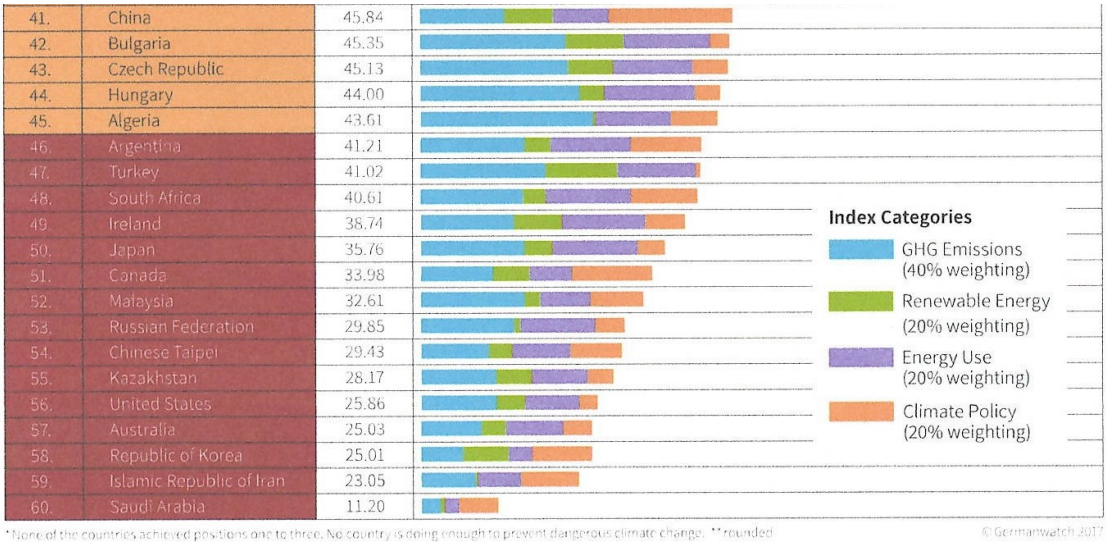
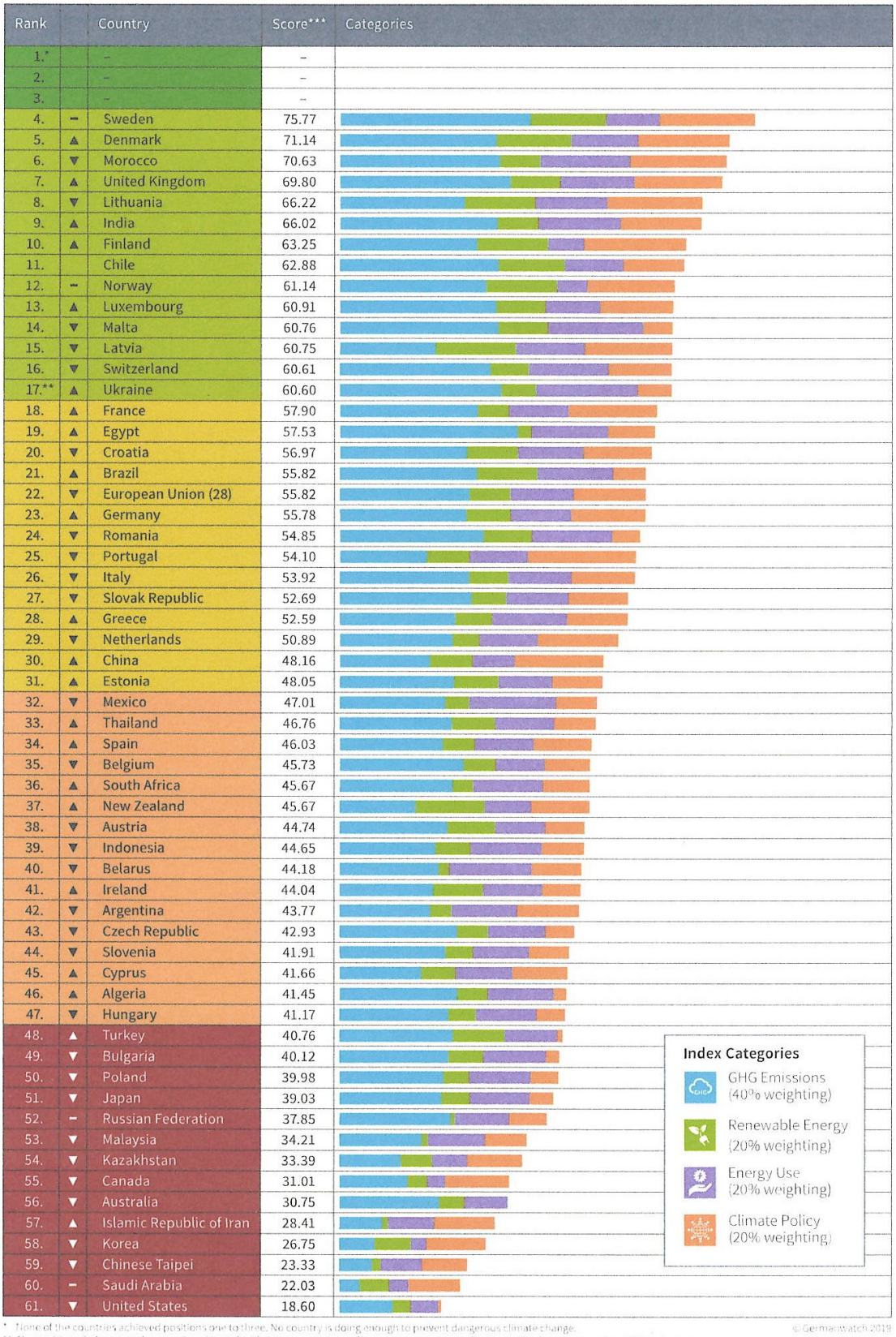
200 Burck, Jan; Hagen, Ursula; Marten, Franziska; Höhne, Niklas; Bals, Christoph, *The Climate Change Performance Index: Results 2019*, Germanwatch, Bonn, p. 20



Climate Change Performance Index 2019, p. 11. See footnote 198 for the link to download the full report

Lastly, in the 2020 report, Korea has reached the lowest position yet, ranking 59th (this time out of 61 countries). According to the report the country failed to achieve any improvement in the indicators of the very low-rated GHG Emissions and Energy Use categories. This reflects high current levels of per capita GHG emissions and per capita energy use, with increasing trends over recent years as well as insufficient 2030 targets in both categories. National experts highlight that the country will not meet its 2020 emission reduction target and that amendments of that target and the energy use target will most likely still be too unambitious to put the country on a well-below 2°C pathway. Again, in the Renewable Energy category, the Republic of Korea continues to receive a very high rating for its renewable energy growth rate. However, as the current share of renewable energy in the energy mix remains at a very low level, the country is still among medium-performing countries in the Renewable Energy category[201].

201 *The Climate Change Performance Index: Results 2020*, Germanwatch, Bonn https://www.climate-change-performance-index.org/country/korea (last visited on January 4th, 2020). To download the full text visit the following link: https://www.climate-change-performance-index.org/the-climate-change-performance-index-2020 ((last visited on January 4th, 2020))



Rank		Country	Score***	Categories
1.*		–	–	
2.		–	–	
3.		–	–	
4.	–	Sweden	75.77	
5.	▲	Denmark	71.14	
6.	▼	Morocco	70.63	
7.	▲	United Kingdom	69.80	
8.	▼	Lithuania	66.22	
9.	▲	India	66.02	
10.	▲	Finland	63.25	
11.		Chile	62.88	
12.	–	Norway	61.14	
13.	▲	Luxembourg	60.91	
14.	▼	Malta	60.76	
15.	▼	Latvia	60.75	
16.	▼	Switzerland	60.61	
17.**	▲	Ukraine	60.60	
18.	▲	France	57.90	
19.	▲	Egypt	57.53	
20.	▼	Croatia	56.97	
21.	▲	Brazil	55.82	
22.	▼	European Union (28)	55.82	
23.	▲	Germany	55.78	
24.	▼	Romania	54.85	
25.	▼	Portugal	54.10	
26.	▼	Italy	53.92	
27.	▼	Slovak Republic	52.69	
28.	▲	Greece	52.59	
29.	▼	Netherlands	50.89	
30.	▲	China	48.16	
31.	▲	Estonia	48.05	
32.	▼	Mexico	47.01	
33.	▲	Thailand	46.76	
34.	▲	Spain	46.03	
35.	▼	Belgium	45.73	
36.	▲	South Africa	45.67	
37.	▲	New Zealand	45.67	
38.	▼	Austria	44.74	
39.	▼	Indonesia	44.65	
40.	▼	Belarus	44.18	
41.	▲	Ireland	44.04	
42.	▼	Argentina	43.77	
43.	▼	Czech Republic	42.93	
44.	▼	Slovenia	41.91	
45.	▲	Cyprus	41.66	
46.	▲	Algeria	41.45	
47.	▼	Hungary	41.17	
48.	▲	Turkey	40.76	
49.	▼	Bulgaria	40.12	
50.	▼	Poland	39.98	
51.	▼	Japan	39.03	
52.	–	Russian Federation	37.85	
53.	▼	Malaysia	34.21	
54.	▼	Kazakhstan	33.39	
55.	▼	Canada	31.01	
56.	▼	Australia	30.75	
57.	▲	Islamic Republic of Iran	28.41	
58.	▼	Korea	26.75	
59.	▼	Chinese Taipei	23.33	
60.	–	Saudi Arabia	22.03	
61.	▼	United States	18.60	

* None of the countries achieved positions one to three. No country is doing enough to prevent dangerous climate change.

** The position of Ukraine in the overall ranking is highly influenced by the effects of the ongoing conflict in the Donbas region on key CCPI indicators. For more information please refer to the country text on page 19.

Climate Change Performance Index 2020, p. 9. See footnote 55 (second link) to download the full text

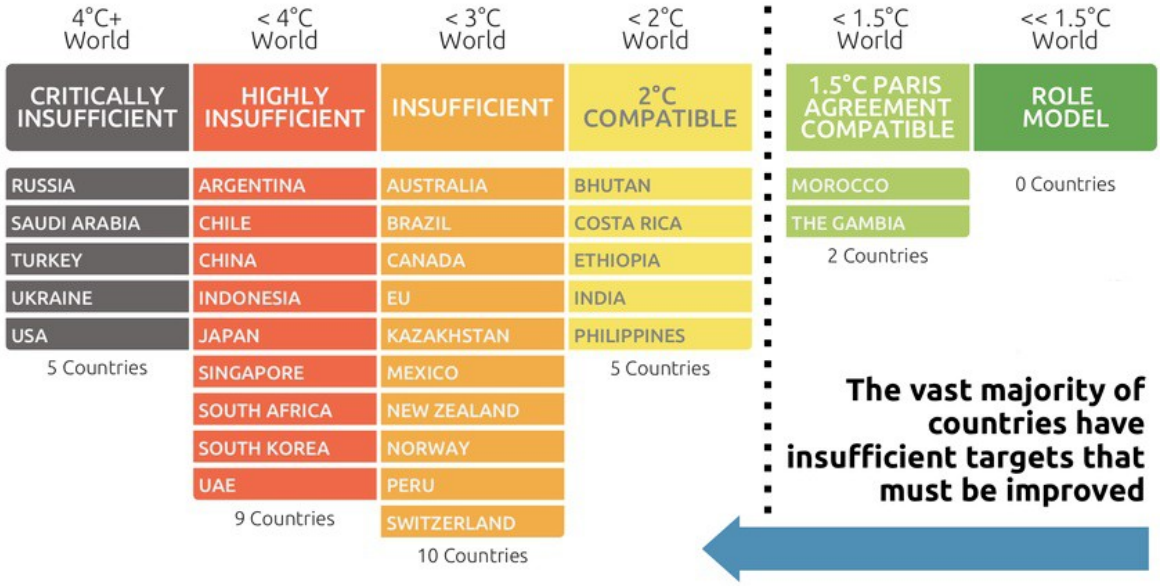
South Korea's Scorecard, Climate Change Performance Index 2020. See footnote 55 (first link) to download

2.4.2 The Climate Action Tracker Report

Next, I am going to present the results from the Climate Action Tracker reports for the years 2018 and 2019. The Climate Action Tracker is an independent scientific analysis that tracks government climate action and measures it against the globally agreed Paris Agreement aim of holding warming well below 2°C, and pursuing efforts to limit warming to 1.5°C". This program stems from the collaboration of two organisations, Climate Analytics and New Climate Institute. CAT quantifies and evaluates climate change mitigation commitments, and assesses whether countries are on track to meeting those[202]. The CAT ratings are based on climate commitments in (I)NDCs. In particular, the CAT rates the overall (I)NDC target, which could be met through a combination of domestic emission reductions and the purchase of credits through international market mechanisms[203].

According to the reports from both years, which see no change in Korea's situation, South Korea's 2030 target is rated "Highly Insufficient." The "Highly Insufficient" rating indicates that South Korea's climate commitment in 2030 is not consistent with holding warming to below 2°C, let alone limiting it to 1.5°C as required under the Paris Agreement, and is instead consistent with warming between 3°C and 4°C[204]. Furthermore, the reports also state that If they were to rate South Korea's projected emissions levels in 2030 under current policies—which does not include the new administration's proposed changes to the electricity generation mix—we would rate South Korea "Critically insufficient," indicating that South Korea's current policies in 2030 are consistent with a warming of over 4°C: if all countries were to follow South Korea's approach, warming would exceed 4°C[205].

202 Climate Action Tracker, *What is CAT?*, https://climateactiontracker.org/about/ (last visited on January 4th, 2020)
203 Climate Action Tracker, *South Korea's fair share*, https://climateactiontracker.org/countries/south-korea/fair-share/ (last visited on January 4th, 2020)
204 Ibidem
205 Ibidem



CAT country ratings of Pledges and Targets, 2019 update[206]

2.4.3 The Brown To Green Report by Climate Transparency

Finally, I am going to illustrate the results of the Brown to Green Report by Climate Transparency. Climate Transparency is a global partnership with «a shared mission to stimulate a 'race to the top' in G20 climate action and to shift investments towards zero-carbon technologies through enhanced transparency»[207]. The project's goal is to bring together the most authoritative climate assessments and expertise of stakeholders from G20 countries. Jointly, these experts develop a credible, comprehensive and comparable picture on G20 climate performance: The Brown to Green Report. This report covers easy-to-use information on all major areas such as mitigation and climate finance and includes detailed fact sheets on all G20 countries. It is published on an annual basis on the eve of the G20 Summit[208].

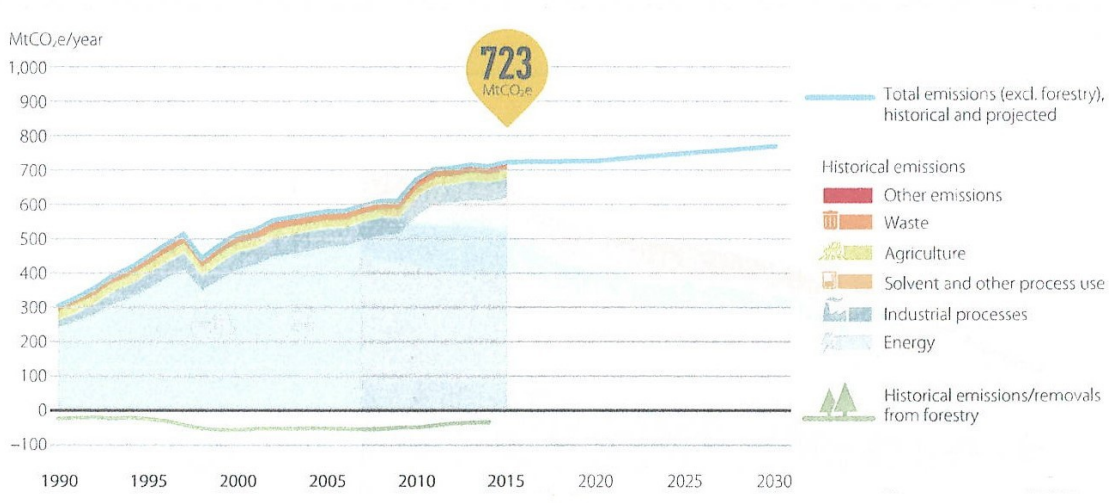
The 2018 Brown to Green Report states that, based on implemented policies, South Korea's GHG emissions are set to increase to around 737 to 753 MtCO2eq in 2030

206 Climate Action Tracker, Climate crisis demands more government action as emissions rise, https://climateactiontracker.org/publications/climate-crisis-demands-more-government-action-as-emissions-rise/ (last visited on January 4th, 2020)

207 About Climate Transparency, https://www.climate-transparency.org/about (last visited on January 4th, 2020)

208 Ibidem

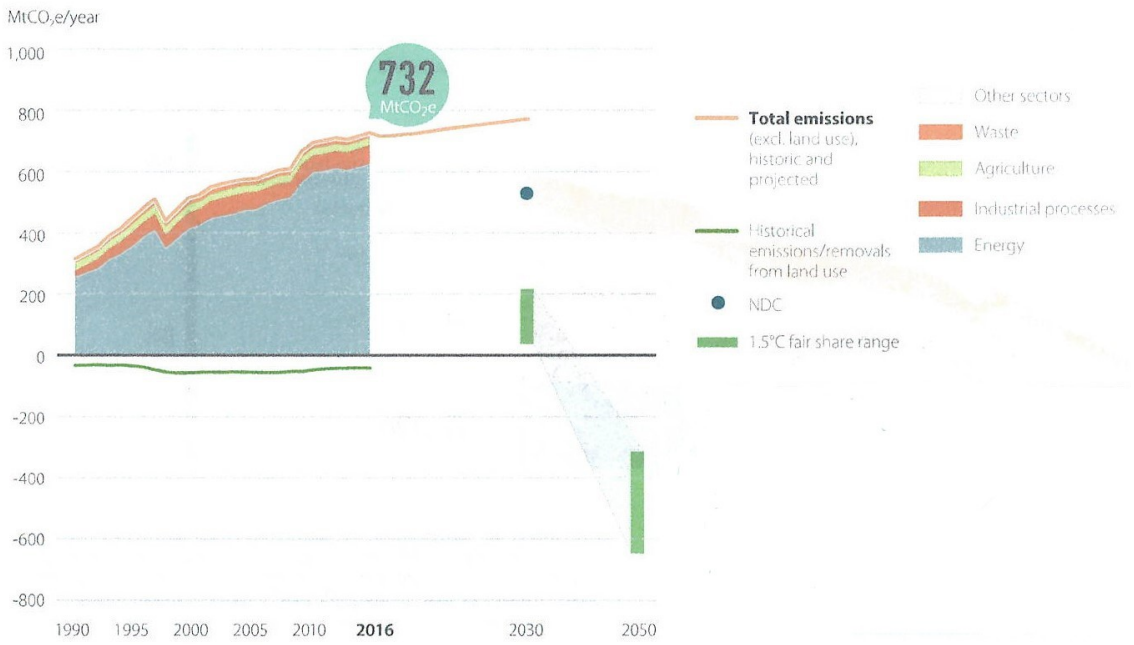
(excluding forestry)[209], instead of diminishing; this emission pathway is not compatible with the Paris Agreement's target. Also, as the report shows, GHG emissions per capita are well above the G20 average: South Korea's is set at 13.3 whereas the G20 average is 8[210]. Nonetheless, as explained also in the CCPI reports, the country's recent policy changes to increase the share of renewable energy sources in electricity generation is promising[211].



Korea's total GHG emissions across sectors, Brown to Green report 2018, Climate Transparency, p. 3

Again in the 2019 Brown to Green Report the situation seems dire. As all other reports have shown, South Korea is not on track for the target of a 1.5°C world. Korea's fair share range is supposed to be below 213 MtCO2e by 2030 and below -317 MtCo2e by 2050, but data show that under the 2030 NDC target emissions would only be limited to 530 MtCo2e[212]. With regards to per capita GHG emissions, this year's report shows that the South Korea 's value is 13.5 (almost the same as last year, with a slight increase) whereas the G20 average has decreased to 7.5[213]. The 2019 report underlines again the fact that South Korea's emissions have more than doubled since 1990 and are expected to increased slightly until 2030.

209 *Brown to Green Report 2018 – South Korea*, Climate Transparency, p. 1
210 Ibidem, p. 1
211 Ibidem, p. 1
212 *Brown to Green Report 2019 – South Korea*, Climate Transparency, p. 1
213 Ibidem, p. 1



Korea's total GHG emissions across sectors, Brown to Green report 2019, Climate Transparency, p. 3

The 2019 Brown to Green Report, differently from the 2018 one, also contains more sector-specific data. For the Energy and Power sector, the reports states that fossil fuels make up around 81% of South Korea's energy mix (including power, heat, transport fuels, etc.). Despite the increase in renewable energy over the last two decades, the carbon intensity of the energy mix has barely changed[214]. Also, South Korea's economy is very energy intensive and per capita energy supply is one of the highest levels in the G20. Energy related CO2 emissions continue to rise[215]. Finally, South Korea produces 44% of electricity from coal, and several new coal-power plants are due to be built by 2022. To be in line with a 1.5°C pathway, the country should phase out coal by 2030[216]. In the Transport sector, per capita emissions are increasing significantly. The transport sector is still dominated by fossil fuels, and electric vehicles (EVs) make up only 2% of car sales. For staying within a 1.5°C limit, passenger and freight transport need to be decarbonised[217]. In South Korea's Building sector, emissions – including heating, cooking and electricity use – make up a quarter of total CO2 emissions. Per capita, building related emissions are more than double the G20 average[218]. Industry-related emissions make up almost half of CO2

214 Ibidem, p. 4
215 Ibidem, p. 6
216 Ibidem, p. 7
217 Ibidem, p. 8
218 Ibidem, p. 10

emissions in South Korea – much more than the G20 average. Current policies are not sufficient to reduce energy use and emissions in the sector[219]. In order to stay within the 1.5°C limit, South Korea needs to make the land use and forest sector a net sink of emissions, e.g. by halting the expansion of residential areas and by creating new forests[220]. Lastly, South Korea's agricultural emissions are mainly from livestock manure, rice cultivation, and digestive processes in animals, this means that a 1.5°C pathway requires dietary shifts, increased organic farming, and less fertilizer use[221].

2.5 Conclusions

To conclude, in this chapter, i have concentated on GHG emissions reduction policies implemented by South Korea to comply with the Paris Agreement's goal of keeping a global temperature rise this century well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius.

First, I have presented the first Korean Nationally Determined Contribution. In rhis document, required from all countries by the Paris Agreement, the Republic of Korea pledged to reduce GHG emissions by 37% by 2030 from BAU levels. In the same year, The South Korean Government had launched on the national scene its First Basic Plan for Climate Change Response, a comprehensive policy plan with medium and long-term strategies and specific action plans to combat climate change.

To drive the national efforts to reduce GHG emissions, the Korean Government has launched during the years a series of GHG Emissions Reductions Roadmaps, containing detailed expected reductions rates and possible general and sector-specific strategies to reach these goals. The first Roadmap was realesed in 2014 to comply with a 2009 pledge to reduce emissions levels by 30% from BAU in the year 2020. Then, in 2016 a new Greenhouse Gas Reduction Roadmap 2030 was released. It was a revision of the original 2014 map made in order to honour Korea's pledges made in its NDC. Comparing the two roadmaps, it is clear that the new plan sets lower reduction rates in all sectors, with the exception of waste management. Finally, in 2018 a revised version of the Roadmap 2030 was released. This new revision was caused by strong criticisms to the previous version,

219 Ibidem, p. 11
220 Ibidem, p. 12
221 Ibidem, p. 12

accused of allocating a large portion of emissions reduction to overseas reductions without effectively mapping out specific action plans to this end. South Korea has also launched in January 2015 a national Emissions Trading System (also known as K-ETS). The Korean Emissions Trading Scheme (KETS) caps greenhouse gas (GHG) emissions from participants within the scheme and involves the issuance of a corresponding number of emission allowances. Participants must measure their annual emissions and surrender allowances to cover their emission responsibility. Participants that emit less than their allocation can sell their excess allowances, while those who do not have enough allowances to cover their annual emissions need to buy them. Another piece in Korea's mitigation strategy is the GHG & Energy Management Target, which has been operating since 2010. This program designates companies with large amount of GHG emission and energy consumption as the subject of the target management, then imposes them with reduction targets and verifies and keeps track of their performance.

After presenting these national mitigation strategies, I have analysed the contents of the Korean Biennial Update Report and National Communication of 2019, two documents that members of the United Nations Framework Convention on Climate Change have to submit regularly as reports on their climate change mitigation and adaptation efforts.

In the last part of the chapter I have analysed the reports and data collected by three independent bodies whose aim is to monitor progress in the fight against climate change (Climate Action Tracker, Climate Transparency and Climate Change Performance Index), to see whether Korean policies are effective. Unfortunately, the researches by Climate Action Tracker, CCPI and Climate Transparency have shown that the Republic of Korea's implemented plans and policies are not ambitious enough and fall short of the below 2°C aim, let alone the more stringent goal of 1.5°C. The only real sign of positive change comes from the energy sector, in particular with regards to the implementation and use of new renewable sources of energy, topic on which the next chapter will focus.

Chapter Three
South Korea's energy policies

By analysing the world's total greenhouse gases emissions, we can see that energy production is the biggest global emitting sector. In 2017, for example, energy production of all types (land use excluded) accounted for 74.1 % of total emissions[222]; of this, electricity and heat generation alone accounted for almost half[223]. This finding holds true also for individual countries' total emissions, including South Korea. During the 1940s and 1950s, the main Korean CO2 producing sector was agriculture, which produced around 50% of total greenhouse gas emissions. From the 1960s onward, though, the energy sector began to surpass agriculture and rapidly became the main GHG emitting sector in Korea: in 1967 emissions from the energy sector were 60.3% of total emissions (while agriculture's were 28.4%) and fifty years later, in 2017, they accounted for 86%[224] of the total amount of GHG emissions produced by South Korea.

This explain why, in its effort to curb greenhouse emissions to meet international targets, the Republic of Korea has started to give more space in its mitigation policies to making its energy mix more green and reliant on clean and renewable sources of energy. In this chapter I will focus on energy strategies in South Korea. First I will give a short overview on renewable sources of energy. Then I will present the Republic of Korea's main national strategies to improve their energy sector. Since, as we have already anticipated in the previous chapter, one of the main energy sources available to Korea is nuclear power, I will dedicate a paragraph to the issue of radioactive waste management. Finally, since South Korea is extremely reliant on imports of energy, I will briefly talk about its energy diplomacy efforts.

222 J. Gütschow, L. Jeffery, R. Gieseke, A.Günther (2019): *The PRIMAP-hist national historical emissions time series (1850-2017)*. v2.1. GFZ Data Services. https://www.pik-potsdam.de/paris-reality-check/primap-hist/ (last visited on February 6th, 2020)

223 Center for climate and energy solutions, *Global emissions*, https://www.c2es.org/content/international-emissions/ (last visited on February 6th, 2020)

224 *The PRIMAP-hist national historical emissions time series (1850-2017)*, https://www.pik-potsdam.de/paris-reality-check/primap-hist/ (last visited on February 6th, 2020)

3.1 Renewable Energy

As seen in Chapter One, one of the major mitigation policies available is an increase in the use of renewable energy sources. So, what are renewable energies? «Renewable energy is energy from sources that are naturally replenishing but flow-limited; renewable resources are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time»[225]. The main renewable energy sources are five: biomass, hydropower, geothermal, wind and solar. Biomass refers to organic material from plants or animals. The organic material absorbs energy from the Sun through photosynthesis; it is then burned in order to release its chemical energy as heat. Biomass includes wood and wood waste, garbage (also known as municipal solid waste), landfill gas and biogas, ethanol and biodiesel[226]. In hydroelectric power plants, the mechanical energy from flowing water is used to turn a turbine to power a generator and produce electricity[227]. «Geothermal energy comes from the heat generated within the Earth's core. Geothermal reservoirs can be found at tectonic plate boundaries near volcanic activity or deep underground. Geothermal energy can be harnessed by drilling wells to pump hot water or steam to a power plant»[228]. Wind produces electricity by turning wind turbine's blades; a generator then converts the mechanical energy released into electricity[229]. Finally, radiations from the Sun can be used to generate power, using photovoltaic cells, which convert solar energy into electricity. Due to the fact that these cells only generate small amounts of energy, they are often used in combination with other technologies, such as solar panels[230].

3.2 South Korea's energy policies

3.2.1 An overview of South Korea's energy sector

Before starting to analyse South Korea's policies, I want to give a short overview of its

225 US Energy Information Association, *What is renewable energy*, https://www.eia.gov/energyexplained/renewable-sources/ (last visited on February 6th, 2020)
226 National Geographic, *Renewable resources*, https://www.nationalgeographic.org/encyclopedia/renewable-resources/ (last visited on February 6th, 2020)
227 Ibidem
228 Ibidem
229 Ibidem
230 Ibidem

energy sector. In 2015, «287,479 million tonnes of oil equivalent (TOE) in primary energy were consumed in the Republic of Korea. Within that mix, petroleum accounted for 38.1 percent, followed by coal (at 29.7 percent), liquefied natural gas (at 15.2 percent), nuclear power (at 12.1 percent), new and renewable energy (at 4.5 percent) and hydroelectric power (at 0.4 percent). Its total primary energy supply (TPES) was 268.41 million TOE in 2014»[231].. Due to its geographic structure, as seen in Chapter One, The Republic of Korea is an energy-poor country and relies heavily on energy imports from overseas. For example, in 2015 the country imported 94.8 percent of its total energy that year[232]. Also, in the Republic of Korea, both society and industries (including semi-conductors, petrochemicals, steel, and automobile) are power-intensive: the country is among the 10 largest energy consumers in the world, ranking 8th[233]. Also in 2015, «the Republic of Korea had a power generation capacity of 97,648,761 kilowatt hours (kWh) and 528,091 gigawatt hours (GWh) of power generation. Thermal power (at 60.3 percent) and nuclear power (at 31.2 per cent) produced the most electricity. Renewable energy combined with hydro electricity and alternative energy accounted for 4.4 per cent, whereas the share of coal was 39.3 percent in 2015»[234].

In recent years awareness has grown about the threat posed by certain types of energy sources. Fore example, the increasing occurrence of earthquakes near to or in regions with a high density of nuclear power plants have raised safety concerns. At the same time, air pollution, caused by the combustion of coal and other fossil fuel in power plants has become a serious threat to public health[235]. In a later paragraph we will see that these issues have led the new Korean government, elected in 2017, to move national policies towards less reliance on fossil fuels and a nuclear phase-out.

In the Korean policy debate clean sources of energy are divided in two categories: New Energy and Renewable Energy. New energies include hydrogen energy, fuel cells, energy from liquefied or gasified coal and energy from gasified heavy residual oil. Renewable

231 Sun-Jin Yun, Yeon-Mi Jung, *Energy policy at a crossroads in the Republic of Korea*, Friedrich-Ebert-Stiftung, Seoul, 2017, p. 6

232 Ibidem, p. 6

233 Ministry of Foreign Affairs, *Energy*, http://www.mofa.go.kr/eng/wpge/m_5657/contents.do (last visited on February 6th, 2020)

234 Sun-Jin Yun, Yeon-Mi Jung, *Energy policy at a crossroads in the Republic of Korea*, pp. 6-7

235 Jong ho Hong [et al.], *Long-term energy strategy scenarios for South Korea: Transition to a sustainable energy system*, in Enegy Policy, vol 127, 2019, p. 426

energy include the main renewable sources indicated above[236]. «According to a recent report by the Korea Institute of Energy Research, South Korea's potential renewable energy capacity is estimated to be around 557Mtoe per annum. This is more than double the amount of the total final energy consumed in 2014 (excluding non-energy use of primary sources) and over 10 times more than the total electricity generated»[237].

3.2.2 South Korea's energy policies: the Basic Energy Plan and the Master Plan for Electricity Demand and Supply

As seen in Chapter 2, both Korea's Nationally Determined Contribution and the three GHG Emissions Reduction Roadmap contained relevant sector-specific provisions on energy. During the years, though, the country has designed a specific strategy, complementary but distinct from the general GHG reduction plan, for making its energy sector more sustainable.

South Korea's energy strategy rests on two main pillars: the Basic Energy Plans and the Master Plans for Electricity Demand and Supply.

The Basic Energy Plans represent the primary source of guidance on all areas pertaining to energy, including the definition of mid- to long-term sector-specific and local energy policies. The Basic Energy Plan is changed every five years by the Ministry of Trade, Industry and Energy[238]. Basic Energy Plans must include:

> «matters concerning trends and prospects of the domestic and overseas demand and supply of energy; matters concerning measures for stable securing, import, supply and management of energy; matters concerning the targets of demand for energy, the composition of energy sources, the saving of energy and the improvement of efficiency in the use of energy; matters concerning the supply and use of environment-friendly energy, such as new and renewable energy; matters concerning measures for the safety control of energy; matters concerning the development and diffusion of technology related to energy, the training of professional human resources, international cooperation, the

236 Sun-Jin Yun, Yeon-Mi Jung, *Energy policy at a crossroads in the Republic of Korea*, pp. 6-7
237 Jong ho Hong [et al.], *Long-term energy strategy scenarios for South Korea: Transition to a sustainable energy system*, p. 426
238 Sun-Jin Yun, Yeon-Mi Jung, *Energy policy at a crossroads in the Republic of Korea*, p. 8

development and use of natural resources of energy and welfare in energy»[239].

The first Basic Energy Plan was established in 1997 and covered the 1997-2006 period. The second Basic Energy Plan, released in 2002 for the 2002–2011 period, was cut short after a change of government in 2006 led to a change of the legislation in the same year. The new Framework Act on Energy set a new time parameter for the Basic Energy Plans, which from then onward would have covered a 20-year period instead of a 10-year one. Due to this change, the next plan introduced, which covered the 2008-2030 period, was regarded as the "first" Basic Energy Plan[240].

The second Basic Energy Plan, for the years 2013–2035, was launched by the Korean government, led by Park Geun-hye in January 2014. This new Basic Energy Plan specified six priority policy objectives: «(i) changing energy policy towards demand-side management, (ii) establishing a decentralized generation system, (iii) harmonizing the environment and safety, (iv) strengthening energy security, (v) ensuring a stable supply for each energy source and the system as a whole and (vi) promoting energy policy across the population»[241]. The Basic Energy Plan estimates energy demand by the target year and outlines the way to meet that demand. In the second plan, «total energy demand was projected to increase by 1.3 per cent annually until 2035, which means an increase of 37.1 percent over the base year of 2012. Electricity demand was projected to increase by nearly 2.5 percent every year, to a total of 179.5 percent by 2035»[242]. To meet this projected increase in energy and electricity demand, the Basic Energy Plan proposed to expand the share of nuclear energy to 29 percent and new and renewable energies to 11 percent in the energy mix in 2035[243].

If we compare the current Basic Energy Plan with its previous versions, it results evident that there are no substantial changes. «It reflects shifted emphasis on demand-side management and expansion of the decentralized generation system. However, nuclear energy was selected as an alternative power option to respond to climate change, justifying this choice with reduced greenhouse gas emissions and a reliant electricity supply. To reach the targeted share of 29 per cent of nuclear power of the TPES in 2035, five to seven

239 Ibidem, p. 8
240 Ibidem, p. 8
241 Ibidem, p. 8
242 Ibidem, p. 10
243 Ibidem, p. 10

additional nuclear reactors would need to be constructed, reaching more than double of the current installed capacity»[244].

Master Plans for Electricity Demand and Supply cover a 15-year period and are revised every two years by the Ministry of Trade, Industry and Energy. These Plans provide the basic direction of power supply and demand, as well as a long-term prevision of power supply and demand, a plan for power installations, the management of power supply and demand and other related matters. The Master Plans for Electricity's main aim is to ensure the "stable supply of electricity". The first Master Plan for Electricity was launched in 2002. In 2015 the Park Geun-hye government launched, alongside the second Basic Energy Plan, the seventh Master Plan for Electricity Demand and Supply. One of the core objectives of this Plan was the construction of two additional nuclear reactors.

In 2017, The eighth Master Plan for Electricity was launched to cover the year 2017 to the year 2031. In this eighth plan, peak power demand was estimated at 100.5GW for the year 2030, about 11 percent (12.7GW) lower than the estimate of the 7th plan. Because of this, the South Korean government predicted that the power demand would decrease so much so to make it safe enough to stop the operation of nine of its nuclear reactors. Up until the seventh Master Plan for Electricity, economic feasibility had been a crucial factor in determining the share of sources in electricity generation. With the eighth Plan, more emphasis was put on environmental effects and safety[245].

3.2.3 The issues of coal-fired plants and nuclear power generation

As seen above, previous Korean governments regarded the expansion of nuclear power generation as a major strategy for climate change mitigation and developed plans to expand nuclear power production. The nuclear reactors currently in operation in South Korea are 24, with five more under construction and four being prepared for construction to be completed by 2017[246]. This would mean that a total of 33 nuclear reactors would be operable in less than a decade, if none of the aged reactors were shut down permanently (one, though, has already been stopped, the Kori-1). As said in a previous paragraph, in the last years concerns have started to emerge about nuclear power production. For instance, «the density of nuclear power reactors, calculated by comparing the capacity of nuclear

244 Ibidem, p. 10
245 Ibidem, p. 10
246 Ibidem, p. 12

reactor facilities to the area of national territory, is the highest in the world. To make things worse, some of the biggest nuclear plants are near or in highly populated areas. For example, the population living within a 30-km radius of the nuclear power plants in Kori is more than 3.8 million people, and in Wolsung it is 1.3 million people[247]. This means that the effects of an accident would be grave. Despite these risks, «the Lee and Park governments promoted nuclear power as a major method of climate change mitigation with stable electricity supply and planned for further expansion with the argument that nuclear power has minimal CO2 emissions»[248].

Another issue that started to raise concerns in relation to energy production was the continued use of coal-fired plants, in particular the high levels of fine dust released by these facilities. Starting from the late 1990s, the public interest in the issue of fine dust[249] has increased. Former Korean governments, in particular the last two, had included the construction of an additional 20 coal-fired power plants before 2025 in the sixth and seventh Master Plan on Electricity.

> «The 53 coal-fired power plants in operation have a generation capacity of 26,273.6 MW of electricity. The 11 coal-fired power plants under construction were expected to contribute 9,680 MW, and 9 plants that were planned would add 8,420 MW, increasing electricity generation capacity by 68.9 per cent. Ten of the 53 coal-fired power plants in operation are aged, therefore the Moon government plans to phase them out. But the remaining 43 plants will be efficiently upgraded, and an additional 20 plants will be built as planned. According to the plan of the Park government, the proportion of coal-fired power plant capacity in the energy mix would be reduced, from 27 percent in 2014 to 26.4 percent in 2019. However, the installed capacity of coal-fired power plants would increase, from 26.3 GW in 2014 to 41.5 GW in 2029, and the proportion of coal-fired power generation would also increase, from 36.6

247 Ibidem, p. 12

248 Ibidem, p. 12

249 Air pollutants are substances in the air that can have adverse effects on humans and the ecosystem. The substance can be solid particles, liquid droplets, or gases. Particle pollution is produced when moisture in the air combines with fine particle matter. Fine dust pollution is air pollution caused by fine particulate matters, caused by the combustion of fossil fuels, like oil or coal, and fumes from internal-combustion engines. This type of pollution can also contain other elements like smoke, nitrates, dirt or metals, an make the air appear hazy.

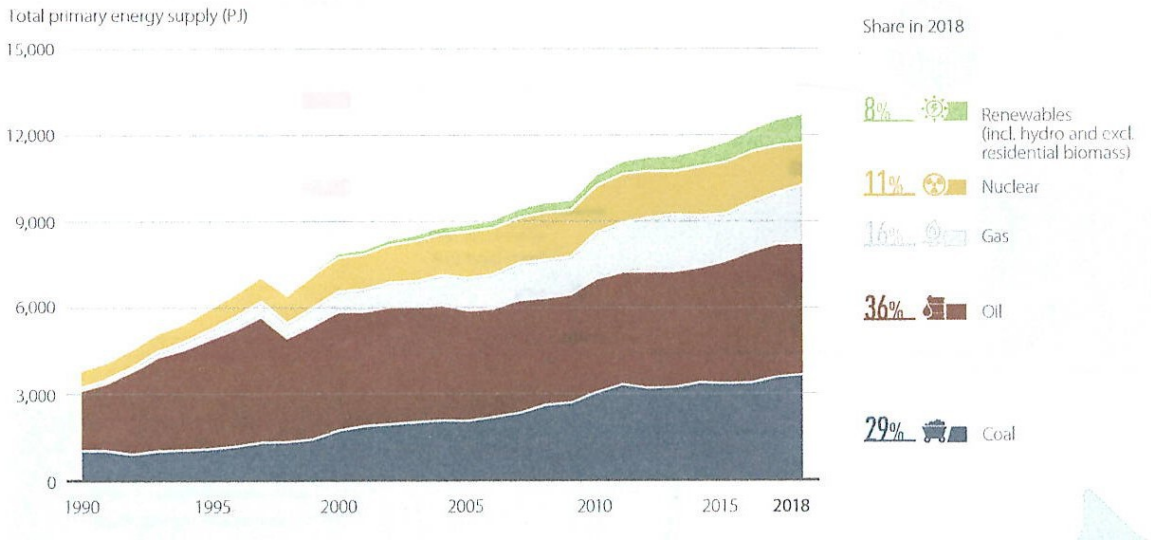
percent to 38.3 percent during the same period»[250].

Since the country's fine dust derives mainly from coal-fired power plants (and diesel-powered auto-mobiles), the expansion in the construction of coal-fired power plants stirred social controversy due to a worsening in air quality, which is especially severe in the spring season, when yellow dust and more fine dust from China blow in.

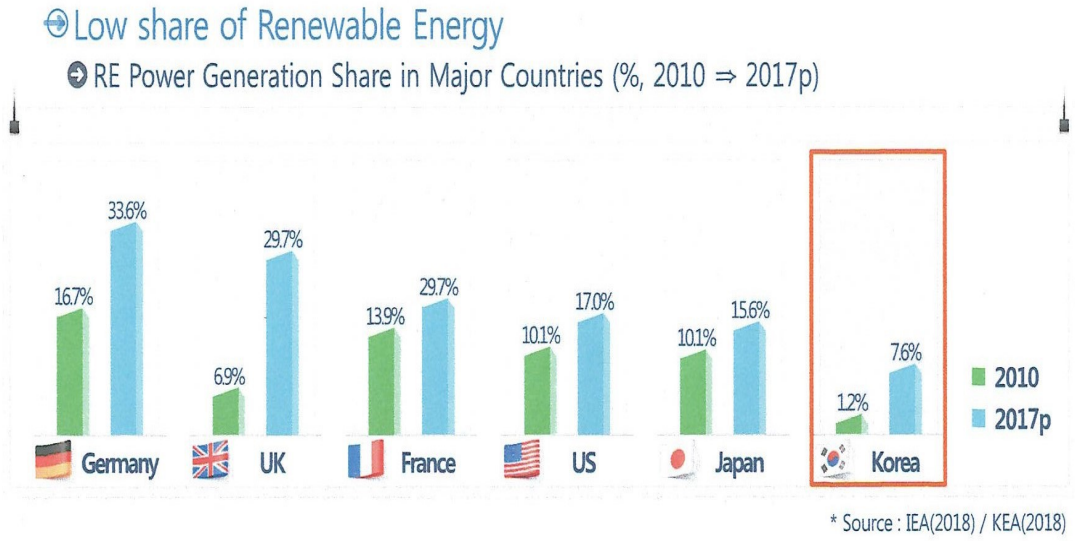
3.2.4 The Renewable Energy Roadmap 3020

Because of the increasing protests against the increased fine dust pollution, the Moon government has announced the new goal of reducing coal-fired power plants from 39.6 percent in 2016 to 23.7 percent in 2030. Alongside this, and to confront growing concerns, the Moon government also plans to accelerate the nuclear phase out. To achieve these two goals, it announced in December 2017 the Renewable Energy Roadmap 3020. The Roadmap 3020's main objective is to increase renewable energy's share of generation capacity from the current rate of 7-8 percent to 20 percent by 2030[251] and to up to 35 percent in 2040[252]. Of the 20 percent proportion of renewable sources in the energy nix in 2030 57 percent would be solar (36,5 Gigawatts), 28 percent wind (17.7 GW), 6 percent waste (3,8 GW), 5 percent biomass (3,3 GW) and 4 percent hydroelectric (2,5 GW)[253].
The Roadmap 3020 also asserts that the government will allocate funds toward the project of up to 18 trillion won ($16 billion)[254].

250 Sun-Jin Yun, Yeon-Mi Jung, *Energy policy at a crossroads in the Republic of Korea*, pp.12-13
251 Ji-hye Shin, *Korea steps in right direction for renewable energy, but challenges await*, The Korea Herald, http://www.koreaherald.com/view.php?ud=20190207000497 (last visited on February 6th, 2020)
252 Institute for energy economics and financial analysis, *South Korea adopts energy policy pushing renewables, reducing coal and nuclear*, https://ieefa.org/south-korea-adopts-energy-policy-pushing renewables-reducing-coal-and-nuclear/ (last visited on February 6th, 2020)
253 Energy Transition, *South Korea's move towards renewables*, https://energytransition.org/2018/06/south-koreas-move-towards-renewable-energy/ (last visited on February 6th, 2020)
254 Ji-hye Shin, *Korea steps in right direction for renewable energy, but challenges await*, The Korea Herald, http://www.koreaherald.com/view.php?ud=20190207000497 (last visited on February 6th, 2020)

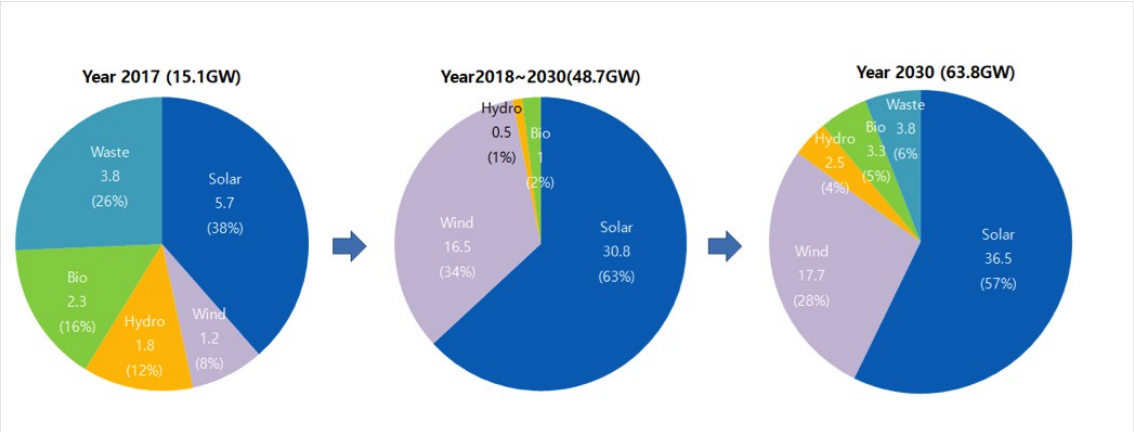


South Korea's energy Mix 1990-2018, Brown to Green Report 2019 – South Korea, p. 4



Status of renewable energy in South Korea 2000-2017[255]

255 Sanghoon Lee, *Renewable Energy 3020 Plan and Beyond, REvision2019: Renewable Revolution*, p. 4. To download the document, visit the following link: https://www.renewable ei.org/en/activities/events/20190306.php (last visited on February 6th, 2020)



Renewable Energy 3020 change in rates[256]

This increase in renewable sources would help to achieve the country's new power plan to decrease the share of nuclear from 30% to 24%[257]. «Six planned nuclear reactors will be cancelled, and the licenses of old nuclear reactors will not be renewed. The 24 nuclear reactors currently in operation will be closed by 2080. In addition, the current bio- and waste energy-oriented portfolio of renewable energy will be transformed in to a solar- and wind power-oriented one. There will be support for cooperatives and citizen-based small scale solar panel businesses»[258].

The Moon government began to push toward the phasing out of nuclear plants right after it was elected. Soon after the launch of the new administration, discussions on the cancellation of two new nuclear plants, Shin Kori No. 5 and 6, started. This idea, though, immediately had to face a series of obstacles. Both power plants were already under construction, and were already around 28% completed; hence, their cancellation would have cost around 2.6 trillion won (US$2.3 billion)[259]. The government proposal also caused a strong backlash from different groups, including professors in nuclear engineering, electronic and energy-relevant fields, the Korea Hydro & Nuclear Power Coroporation (KHNP) labour union, conservative media, reactor construction companies and residents

256 Energy Transition, *South Korea's move towards renewables*, https://energytransition.org/2018/06/south-koreas-move-towards-renewable-energy/ (last visited on February 6th, 2020)

257 David Dalton, *As South Korea Plans To Reduce Nuclear, Energy Imports Remain Among Highest In World*, The Independent Nuclear News Agency, https://www.nucnet.org/news/as-south-korea-plans-to-reduce-nuclear-energy-imports-remain-among-highest-in-world (last visited on February 6th, 2020)

258 South Korea's move towards renewables, Energy Transition, https://energytransition.org/2018/06/south-koreas-move-towards-renewable-energy/ (last visited on February 6th, 2020)

259 Ibidem

living around reactor construction sites. The main argument against the cancellation of Shin-Kori 5 and 6 were that this project would have led to local employment decline, local economic damage and compensation problems for residents[260].

In the face of such strong resistance to the project, the government decided to assemble the Public Engagement Commission, a civilian-led committee with the task of studying the feasibility of the decision to cancel the construction of Shin-Kori 5 and 6. The committee had nine members from various industry areas; since the idea behind the creation of this Committee was to represent the public's opinion nuclear experts were not included as members. A group of 471 citizens took part in an e-learning process and a three day workshop and was later surveyed by the committee. During the deliberative period, the construction of the two reactors was temporarily halted. In the final survey of the 471 members, 59.5% supported resuming construction, outnumbering the 40.5% who wished to stop construction, therefore the Committee recommended resuming construction of the two power plants, recommendation which the South Korean government followed[261]. It is noteworthy to mention that the Public Engagement Commission also recommended the gradual reduction of the share of nuclear power[262], given a small but consistent growth in public approval of the Roadmap 3020.

3.2.5 Obstacles to the renewable energy transition

Nevertheless, the Korean government still has to face some challenges in the implementation of its energy sector policy plans. First, although the recent public engagement on the construction of Shin-Kori 5 and 6 reactors revealed public consensus on the reduction of nuclear power, many Koreans still believe nuclear power to be inevitable to meet the high power demand, even though they are aware that it is not a safe solution; a sort of necessary evil[263].

As Sun-Jin Yun and Yeon-Mi Jung, two Korean researchers, underlined, even after the Fukushima nuclear disaster in 2011, there was not much change in energy policy for the

260 Sun-Jin Yun, Yeon-Mi Jung, *Energy policy at a crossroads in the Republic of Korea*, p. 5

261 Energy Transition, *South Korea's move towards renewables*, https://energytransition.org/2018/06/south-koreas-move-towards-renewable-energy/ (last visited on February 6th, 2020)

262 Institute for energy economics and financial analysis, *South Korea adopts energy policy pushing renewables, reducing coal and nuclear*, https://ieefa.org/south-korea-adopts-energy-policy-pushing-renewables-reducing-coal-and-nuclear/ (last visited on February 6th, 2020)

263 Sun-Jin Yun, Yeon-Mi Jung, *Energy policy at a crossroads in the Republic of Korea*, p. 22

Republic of Korea, despite its geographic proximity to Japan. «Even though the incident contributed to greater awareness among Koreans regarding the risks associated with nuclear power and more active post-nuclear protests resumed, no significant change occurred in policy planning and implementation under the Lee and Park governments, which did not take the public's concerns seriously»[264]. Real concerns started to arise amongst the Korean public, and consequently the Korean government, after the occurance of a 5.8 magnitude earthquake in the Gyeongju area in September 2016: he earthquake's epicentre was only 28 km from the Wolsung nuclear power plants. At present, nuclear phase-out has broader social support, but the issue is still controversial. Korean public opinion is split between those who oppose the government plan (pro-nuclear professors and experts, the KHNP labour union, reactor construction companies, workers of fuel manufacturing) and those who support it, for example the People's Action for Post-Nuclear, a coalition of environmental organizations, religious groups and consumer cooperatives, opposing the use of nuclear power as a source of energy[265].

Another obstacle Korea faces in increasing its renewable-produced energy is cost related: the cost of renewable energy and natural gas-fired power plants is, as of now, much higher than bituminous coal-fired and nuclear power facilities. The matter is made worse by the geographic structure of Korea – it is mainly a mountainous peninsula -, which, as we have seen, renders this country extremely energy-poor. This, in turn, means that an increase in the use of renewable energy sources, in particular of solar and wind power energy, would lead to a rise in electricity costs. According to the 2017 Renewable Energy Roadmap 3020, the expansion of renewable energy to 20 percent would drive energy prices up by 10.9 percent by 2030, but experts estimate that the actual increase could be higher[266]. To make this increase more palatable to the public Sun-Jin Yun and Yeon-Mi Jung suggest introducing proper taxation on energy use, especially electricity. «To expand renewable energy generation and use, it is necessary to add environmental and social costs that occur from fossil- and nuclear-based energy generation into the electricity prices that consumers pay. One option the government can take is to impose fuel taxes on electricity. Currently, the amount of the tax placed on bituminous coal is not high enough, and there is still no tax

264 Sun-Jin Yun, Yeon-Mi Jung, *Energy policy at a crossroads in the Republic of Korea*, p. 14
265 Ibidem, pp. 14-15
266 Ji-hye Shin, *Korea steps in right direction for renewable energy, but challenges await*, The Korea Herald, http://www.koreaherald.com/view.php?ud=20190207000497 (last visited on February 6th, 2020)

on uranium»[267]. Also, creating policies to enhance technological advancements and efficiency improvements could lead to a shift in the energy market with renewable energy gaining competitiveness[268].

3.3 Actors on the Korean energy scene

Part of the new Korean government's plan is to move from a central administration making all energy policy decisions to a decentralized system based increasingly on new actors, new technologies and new regulations. This is due in part to the fact that the actors participating in the energy policy process have increased over the years in both numerical terms and in terms of their interactions and nowadays energy companies and civil society have increasingly joined the energy policy process.

> «Local energy transition movements led by citizens and local governments are on the increase. Local governments have introduced energy efficiency improvements and renewable energy expansion policies closely related to the climate action plan. […] Supported by the international climate change negotiations, local governments are becoming more active in their response to the impacts of climate change. In February 2012, 45 municipalities (the 46th joined later) declared themselves a "Nuclear-Phase Out Energy City", with ambitions to reduce energy consumption through conservation activities and efficiency improvements and to expand the use of renewable energy towards a nuclear-free society. In April 2012, the city of Seoul initiated the "One Less Nuclear Power Plant" campaign. In June 2015, the provincial government of Gyeonggi-do (province) launched its Energy Vision 2030, and in November 2015, the city government of Seoul and the provincial governments of Gyeonggi-do, Chungcheongnam-do and Jeju-do announced a Joint Declaration for Local Energy Transition, which are estimated successful than any other energy transition movements in other regions»[269].

267 Sun-Jin Yun, Yeon-Mi Jung, *Energy policy at a crossroads in the Republic of Korea*, p. 25
268 Ibidem, p. 25
269 Ibidem, pp. 24-25

Civil society-led activities are mainly focused on power saving through energy conservation, efficiency improvements and on the establishment of small-scale solar power plants. Civil society organisations active in energy issues include the Federation for Environmental Movement, which is the country's largest environmental movement group and the Energy Alternatives Center, which changed its name in 2005 to Energy Transition. And was the first to establish a citizen solar photovoltaic power plant in the Republic of Korea. In South Korea also religious organisations are very active on environmental and energy related issues[270].

3.4 Radioactive waste management

As seen in the previous paragraphs, nuclear power remains one of Korea's main sources of energy. This opens the issue of radioactive waste and its management.

The production of energy via nuclear plants results in some waste products. Nuclear waste can be divided into three categories, according to its level of radioactivity: low-, intermediate-, and high-level. Low-level waste (LLW), due to its low level of radioactivity, does not require shielding during handling and transport, and is suitable for disposal in near surface facilities. Low-level waste includes paper, rags, tools, clothing, filters, and other objects which contain small amounts of mostly short-lived radioactivity. To reduce its volume, LLW is often compacted or incinerated before disposal. Intermediate-level waste (ILW), showing higher levels of radioactivity than LLW, requires some shielding. Intermediate-level waste includes resins, chemical sludges, and metal fuel cladding, as well as contaminated materials from reactor decommissioning. Smaller and/or any non-solid item may be solidified in concrete or bitumen for disposal[271]. Finally, high-level waste (HLW), due to its high heat and radioactivity, requires cooling and shielding. High-level waste derives from «the 'burning' of uranium fuel in a nuclear reactor. HLW contains the fission products and transuranic elements generated in the reactor core. High-level waste can be divided in used fuel that has been designated as waste and separated waste from reprocessing of used fuel»[272].

270 Ibidem, pp. 24-25

271 World Nuclear Association, *Radioactive waste management*, https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-wastes/radioactive-waste-management.aspx (last visited on February 6th, 2020)

272 Ibidem

An additional category of nuclear waste comprises of exempt waste and very low-level waste (VLLW), which «contains radioactive materials at a level which is not considered harmful to people or the surrounding environment. It consists mainly of demolished material (such as concrete, plaster, bricks, metal, valves, piping, etc.) produced during rehabilitation or dismantling operations on nuclear industrial sites»[273]. In the nuclear fuel cycle every different step or process produces some radioactive waste. The main difference with other hazardous industrial materials is that the level of radioactivity diminishes with time[274]. The nuclear sector is fully responsible for all of its waste. For this purpose, many permanent disposal facilities are in operation for low- and intermediate-level waste, and facilities for high-level waste and used nuclear fuel are under construction[275].

Contrary to common beliefs, nuclear waste repositories do not pose a health threat. This is due to the fact that the quantity of materials which would be released in the surrounding environment in the event of a leak would be very small[276].

Since when used fossil fuel is taken out of the reactor it is both hot and radioactive, before being disposed of it is kept stored in water to allow it to cool. After an initial period of cooling, the used fuel can either be left in wet storage or transferred into a dry facility. This would give enough time for both the heat and radioactivity to diminish, which would, in turn, make the recycling and disposal easier. As of now, only two main radioactive waste management solutions exist: recycling used nuclear fuel or direct disposal[277]. Recycling «has, to date, mostly been focused on the extraction of plutonium and uranium, as these elements can be reused in conventional reactors. This separated plutonium and uranium can subsequently be mixed with fresh uranium and made into new fuel rods. Some of the by-products (approximately 4%), mainly the fission products, will still require disposal in a repository and are immobilised by mixing them with glass, through a process called vitrification»[278]. Direct disposal consists of the burial of used nuclear fuel, designated as

273 Ibidem
274 Ibidem
275 World Nuclear Association, *What is nuclear waste, and what do we do with it?*, https://www.world-nuclear.org/nuclear-essentials/what-is-nuclear-waste-and-what-do-we-do-with-it.aspx (last visited on February 6th, 2020)
276 Ibidem
277 Ibidem
278 Ibidem

waste, in an underground repository. The used fuel «is placed in canisters which, in turn, are placed in tunnels and subsequently sealed with rocks and clay»[279].

Government policy dictates whether certain materials should be categorised as waste and which management strategy will be used, basing the decision on political and economic, as well as technological, considerations[280].

In Korea nuclear waste management is regulated in the Nuclear Safety Act (NSA). The Act defines Radioactive Waste as «radioactive materials or other materials contaminated by such radioactive material (including spent nuclear fuel), which is all subject to disposal»[281]. The Nuclear Safety Act, divided nuclear waste into two categories. The first is High-Level Radioactive Waste defined as «radioactive waste with specific activity greater than 4,000 Bq/g of alpha-emitting radio nuclides with a half-life of more than 20 years and a heat-generating capacity exceeding 2 kW/m3»[282]. This definition means that only spent nuclear fuel (SNF) is classified as high-level waste. The second category is Low-and-Intermediate Level Waste. LILW is divided into three subcategories: very low level waste (VLLW), low level waste (LLW) and intermediate level waste (ILW)[283].

In Korea, the national policy on radioactive waste management is determined by the Atomic Energy Promotion Commission (AEPC). In 1998, the AEPC developed a "National Radioactive Waste Management Policy" aiming to construct and operate a LILW disposal facility by 2008 and a centralized SNF storage facility by 2016. After a first unsuccessful attempt to find the right site, in 2004, it was decided that an LILW repository should be constructed by 2009, having chosen Wolsong as repository site. As of date, though, South Korea does not have a clear national policy on nuclear waste management yet[284].

For now, Korea takes a "wait & see" approach to high-level waste management, according to which nuclear waste is temporarily stored at each reactor site. First, radioactive waste is placed in wet storage bays for cooling and radioactive decay. Then, after at least a 6-year period of cooling in the storage bays, the waste is put into stainless steel fuel baskets and

279 Ibidem
280 Ibidem
281 International Energy Agency, *Radioactive waste management programmes in OECD/NEA member countries – Korea*, 2016, p. 2
282 Ibidem, p. 2
283 Ibidem, p. 2
284 Ibidem, p. 3

transported to above ground on-site dry storage facilities. In Korea there are two kinds of dry storage facilities used for on-site storage: concrete silos and MACSTOR/KN-400 (M/K-400) concrete storage modules with the capacity of 332,631 bundles and 168,000 bundles respectively. Unfortunately, Korean authorities predict that both wet storage bays and on-site dry storage facilities will reach their maximum capacity in a few years. To expand the insufficient storage space at reactor sites, re-racking and transshipment to neighbouring reactors are utilized, and construction of additional MACSTOR modules at reactor site has been considered[285].

Low-and-intermediate-level waste generated in nuclear power plants is subjected to treatment processes such as volume reduction, stabilization, etc. at on-site treatment facilities, where they are also temporarily stored before being transported to the Wolsong Disposal Center (WLDC) for final disposal[286]. In addition, In July 2014 the Korea Radioactive Waste Agency (KORAD) announced that the first underground nuclear waste disposal facility had been completed. The $1.56 billion disposal facility is located about 80 to 130 meters below sea level; It comprises of six underground silos, a construction tunnel, an operation tunnel, an entrance shaft, and surface facilities. The disposal facility also comprises of a near-surface repository that will store 125,000 drums. The entire facility will be able to store 800,000 drums over the next 60 years before it is completely sealed off[287].

3.5 Energy security and energy diplomacy

First of all, it is important to understand what the concepts of energy security and energy diplomacy entail. This two issues are interconnected and can be seen in a cause-effect relationship.

> «Energy security is considered achieved when energy resources are provided at a sufficient amount and reasonable price in a timely and safe manner. Since the energy sector is one of the most fundamental strategic industry, each country -

285 Ibidem, p. 4
286 Ibidem, p. 4
287 Sonal Patel, *South Korea Begins Burying Nuclear Waste*, https://www.powermag.com/south-korea-begins-burying-nuclear-waste/ (last visited on February 6th, 2020)

either supplier or consumer - looks upon the energy sector as an important national interest. Thus, stable and sufficient procurement of energy resources constitutes one of the most essential responsibilities of a nation. Consumer countries seek to obtain sufficient amount of energy resource and a secure transportation route, while exporting countries are not only interested in maintaining or expanding production levels, but diversification of their exporting markets. But, since under the asymmetric structure of the energy market-where suppliers exert a dominant influence over consumer countries-competitions without collaboration among energy consumer nations are likely to incur only losses to them altogether»[288].

Given that energy security is one of the major preoccupations of modern States and that the competition in the energy sector usually results mostly in loss for all parties involved, energy diplomacy, or cooperation, can be seen as the natural solution to this conundrum. So, what is energy cooperation?

«Energy cooperation in general refers to a type of international cooperation in which joint efforts among multiple nations engage in exploration, extraction, and distribution, and transportation of energy resources, energy stockpiling, energy consumption, energy related facilities construction, and environmental preservation. As demand for energy resources increase, competition for procuring demand for energy resources increase. Attempts by individual countries to enhance their respective energy security agendas would most likely result in endless competition and antagonism, ultimately leading to a zero-sum game. Therefore, countries [...] became aware of the necessity for cooperation in the sphere of energy rather than continuation of an all-out competition»[289].

Asia's impact on global energy security has increased. «Spurred by rapid economic development, the region's energy consumption levels rose fivefold over the period from 1970 to 2009 while the average world energy consumption rate only doubled. […] Current

288 Duckjoon Chang, *Energy and regional cooperation in Northeast Asia*, in The Journal of East Asian Affairs, vol. 21, No. 2 (2007), Institute for National Security Strategy, p. 173
289 Ibidem, p. 172

estimates predict the region's share will rise to well over 40 percent by 2030»[290].

East Asia's main oil and gas reserves are located in Southeast Asia and China, which, despite possessing considerable reserves, has become one of East Asia's largest energy importers. «India is the world's third largest coal producer and ranks among the world's top 20 oil and gas producers. Pakistan also possesses notable levels of carbon fuel reserves. By contrast, North-east Asia's developed economies – Japan, South Korea and Taiwan – have virtually no such energy resources and have thus long maintained high energy-import dependencies, this being historically very pronounced on Middle East oil. Southeast Asia's main energy producers (Indonesia, Thailand, Malaysia, Brunei, Vietnam) are also quickly turning into net energy importers»[291].

East Asian countries will face increasingly acute energy security vulnerabilities, due for the most part to that fact many of them, as explained above, are highly dependent on imported energy and energy sources[292]. Since, as all other regions, to face the climate change challenge, East Asia will have to reduce its dependency on fossil fuels for energy production, an additional problem faced by East Asian countries, with regards to their energy security will be finding ways to unlock the region's potential for the development of its green energy sector, including enhancing renewable energy production, energy efficiency and saving technologies development.

All these predicaments have been made worse by the region's growing industry-based economic development, which has caused an increased in the demand for energy resources and a rapid depletion of local fuel reserves[293].

As seen before, South Korea is an energy-poor country, which means she relies heavily on imports of energy from other States: more than 90 percent of its energy is imported. For example, in 2018, imports of energy and resources costed South Korea 1,459 billion US dollars, nearly 27.3% of its total amount of imports. Such high dependency on energy imports, leaves Korea vulnerable to changes in the global energy market, including rises in prices and a supply-demand imbalance. In addition, «Korea is highly dependent on specific

290 Christopher M. Dent, *Asia and Europe: Meeting Future Energy Security Challenges*, in The Asia-Europe Meeting - contributing to a New Global Governance Architecture: The Eighth ASEMSummit in Brussels, Amsterdam University Press, 2011, p. 128

291 Ibidem, p. 130

292 Ibidem, p. 130

293 Ibidem, pp. 130-131

regions for its imports of energy and resources, including oil and natural gas, which adds to its vulnerability in its energy security. In the case of oil, Korea imports approximately 73.5% of its oil consumption solely from the Middle East»[294].

3.5.1 the North-East Asia arena

One major energy cooperation arena for South Korea, due its geographic position, is, without doubt, the North-East Asia (NEA) region, including Russia. From the mid-1990s, the United States began aggressively promoting globalization policies in this region to hasten domestic reform and putting enormous pressure on the north-eastern Asia countries to convince them to open up their markets. These relentless attempts caused NEA States to become wary of the U.S.-led drive to globalization. Also, following the 1997-1998 Asian financial crisis, disillusionment towards existing regional cooperation bodies, such as APEC, began to emerge, due partly to the belief that the United States were manipulating these institutions to promote its objective of liberalizing the commercial and financial markets of Asia. In response to this, NEA countries agreed on the principle of the necessity for developing common objectives and mutual cooperation, which, in practice, followed two distinct paths. On one hand, Asian countries turned their attention to bilateral cooperation; on the other hand, NEA countries started to believe in the need for multilateral cooperation[295].

Relationships among NEA countries are far from cooperative: there exist historical and political factors which seem to prevent full-scale regional cooperation. Among others, nationalist sentiments and individual States' interests take centre stage. Examples include

> «the Russo-Japanese territorial disputes over the Kuril Islands, Japan's territorial claim over Korea's Dokdo, and territorial rivalry over Shenkaku/Diaoyutai islands between China and Japan, Also, China's controversial and provocative attempt to enlist the history of all of the minority ethnic groups including Koguryo, an ancient Korean state, within Chinese history, more often than not disturb the progress of regionalism. Furthermore, controversy over Japan's apology on its colonial rule over China and Korea during the early 20th century

294 Ministry of Foreign Affairs, *Energy*, http://www.mofa.go.kr/eng/wpge/m_5657/contents.do (last visited on February 6th, 2020)

295 Duckjoon Chang, *Energy and regional cooperation in Northeast Asia*, pp. 169-170

cast considerable doubt on regional cooperation among North-east Asian countries, particularly in South Korea and China. Also, traditional rivalry between Japan and China seems to have been exercising negative influence on regional cooperation in NEA»[296].

As of now, the ultimate goal in regional cooperation between North-east Asia countries seems to be the construction of an economic and security community in the region. Within this framework, energy cooperation could be a promising and viable option for further NEA regional cooperation.
As experts point out, there are several factors that could make energy cooperation in the region appetizing to NEA countries. The first factor is economic rationality.

«Given a complementary nature of the energy market in the NEA region, it seems clear that profit can be attained through regional cooperation by every participant. On one hand, Russia, who ranks 1st in natural gas reserves and 7th in proven oil reserves, is capable of serving as the sole supplier of energy resources for the region. […] The potential of oil and gas reserves from East Siberia is enormous. Current expectation, based on seismic survey and drilling, is more than 20 billion barrels with 6 billion barrels of proven reserves. On the other hand, NEA countries including China, Japan, and South Korea are large, fast growing consumers in the world energy market. Given such a complementary market structure in the NEA region, energy cooperation within the region is expected to reap huge benefits to both consumers and suppliers»[297].

A second factor that could help foster regional energy cooperation is geographic proximity. Another important factor is the existence of common interests in energy security among NEA countries.

«For example, Russia is attempting to expand its energy export market to the Asia and Pacific region concurrent with securing safe transportation lanes.

296 Ibidem, p. 171
297 Ibidem, pp. 172-173

> Major consumer countries in the NEA region need to restructure their energy industry in an effort to enhance energy efficiency, while reducing their dependence on oil and gas imports from the Middle East. Given the common interests in energy security, motivations for cooperation as well as competition among NEA countries exist. [...] It seems that the NEA countries began to realize the benefits of cooperation rather than unlimited competitions and rivalry based on mutual distrust and extreme self-interest. They got a lesson that they are able to obtain positive results with reduced transaction costs, and not severely hurting each other by entering into collaboration»[298].

In addition, environmental preservation could another important factor.

> «Fossil fuels, particularly oil and coal, expel pollutants; the utilization of fossil fuel aggravates environmental problems. Petroleum, the most widely used energy resource, occasionally brings about sea or water pollution precipitated by accidents during shipping of crude oil. Thus, prevention of environmental pollution is considered one of the more important factors in energy cooperation. Development of alternative energy resources constitutes common interests for both energy providers and consumers. Nevertheless, faced with the contradictory dilemma between the need for energy security and the importance of environmental preservation, individual countries tend to place more weight on the former than the latter»[299].

Despite all these encouraging factors, energy cooperation in the North-East Asia region has yet to gain any real momentum. Energy cooperation projects already in place have been proceeding at a slow pace and are based mostly on bilateral action between Russia and other north-east Asian countries. Examples of existing energy cooperation projects among NEA countries include the Sakhalin Project[300], the Irkutsk Gas Project[301] and the East

298 Ibidem, pp. 173-174
299 Ibidem, p. 174
300 For more information on this project visit the following link: https://www.sakhalin-1.com/en-RU (last visited on February 6th, 2020)
301 For more information on this project visit the following link: http://irkutskoil.com/gas/ (last visited on February 6th, 2020)

Siberian Oil Pipeline Project[302].

An example of the successful results of energy cooperation among North-east Asia countries, is the Asia Super Grid project. Launched in 2018 by China and South Korea, the project consists of the creation of a an ocean-floor power network to connect their electricity grids and create a pan-Asian electric power system[303]. The ASG system, once completed would allow the exchange within the region of power generated from renewable sources, mainly solar, wind and hydroelectric. In addition to China and South Korea, Japan, Russia and Mongolia have backed the project. State companies involved in the project will include the State Grid Corporation of China, Korea Electric Power Corporation, Russia's Rossetti and Mongolia's NeCom[304].

According to a report presented by the Korea Electric Power Corporation (KEPCO) to the Korean parliament, the ASG project would cost around 7.2 trillion to 8.6 trillion won. «KEPCO estimated 2.9 trillion won for connecting China's eastern port of Weihai with South Korea's western port of Incheon via undersea power cables that will cover some 370 kilometers. It also estimated 2.4 trillion won to link Vladivostok in the Russian Far East, via North Korea, to the northern part of Gyeonggi Province using land cables, which would cover approximately 1,000 km. To connect with Japan, the report proposed linking Goseong in South Gyeongsang Province with either Kitakyushu or Matsue, both on the northern coasts of Japanese islands, expecting building undersea cables to cost around 1.9 trillion to 3.3 trillion won»[305]. According to analysts, there are important challenges to this project. «Asia does not have a cohesive political body like the European Union that can facilitate grand multilateral infrastructure development. Multilateral projects ultimately rely on geopolitical trust, especially in areas like energy supply and security. This plan could be vastly complicated by financing and legal obstacles, and access to other countries' transmission lines and electricity could give disproportionate leverage to significant power providers and consumers. […] Asia's lack of a comprehensive political framework could

302 For more information on this project visit the following link: https://www.hydrocarbons technology.com/projects/espopipeline/ (last visited on February 6th, 2020)

303 Julian Turner, *Super size me: inside the Asian electricity super grid project,* https://www.power technology.com/features/super-size-me-inside-the-asian-electricity-super-grid-project/ (last visited on February 6th, 2020)

304 Council of Foreign Relations, *An Asia Super Grid Would Be a Boon for Clean Energy—If It Gets Built*, https://www.cfr.org/blog/asia-super-grid-would-be-boon-clean-energy-if-it-gets-built (last visited on February 6th, 2020)

305 *'Northeast Asia super grid' costs at least $6.2 billion: KEPCO* , The Korean Times, https://www.koreatimes.co.kr/www/tech/2018/12/325_260204.html (last visited on February 6th, 2020)

also leave weaker nations more vulnerable to economically dominant and influential powerhouses, like China. These potential risks could exacerbate an already hefty price tag»[306]. Still, if the project is successfully completed and implemented, it will represent a great advancement in Asian energy diplomacy and a great boost to clean energy resources.

3.5.2 The potential of the Asia-Europe arena

Another important energy cooperation arena for Asia, and for South Korea, as seen in Chapter One, is Europe. At a first glance, Asia and Europe do not appear to be natural energy security partners. «Energy trade between them is negligible, and at a general level each region often views energy security from contrasting perspectives owing to development and socio-economic related factors»[307]. Despite this, the two regions' energy security interests are increasingly overlapping, «bound by an ever wider range of shared energy security predicaments and issues, as well as closer interdependencies in the global system generally»[308]. In particular, a Asia-Europe partnership could potentially be very important with regard to energy technology, infrastructure development, finance, governance, policy practice and other areas[309]. Asia-Europe energy relations can have either a bilateral or inter-regional dimension. On one hand, «individual EU member states, especially large ones (e.g. Germany, UK, France) or ones with strong green energy sectors (e.g. Denmark, Sweden), have developed particularly significant bilateral energy relationships with Asian nations». On the other hand, even though the inter-regional dimension is the best suited to foster the strengthening of Asia-Europe energy partnerships, to date, there has been far more dialogue than substantive cooperation accomplished at the inter-regional level. In addition, there are still no «regular ministerial or senior official level meeting processes or any other apparatus in place to manage energy security issues between both regions»[310].

306 Council of Foreign Relations, *An Asia Super Grid Would Be a Boon for Clean Energy—If It Gets Built*, https://www.cfr.org/blog/asia-super-grid-would-be-boon-clean-energy-if-it-gets-built (last visited on February 6th, 2020)
307 Christopher M. Dent, *Asia and Europe: Meeting Future Energy Security Challenges*, p. 141
308 Ibidem, p. 141
309 Ibidem, p. 142
310 Ibidem, p. 138

3.5.3 South Korea's energy diplomacy efforts

South Korea's main energy diplomacy objective is the diversification of its energy import markets[311].

Under the previous government, led by Park Geun-hye, South Korea's energy diplomacy activities virtually stopped. One explanation for this was that the Korean top leadership, including high officials from the legislative branch and the presidential office itself, lacked a real and thorough understanding of the energy security concept. In particular, they didn't understand the importance of energy diplomacy in the pursue of broader national security. A second reason would be that the energy issue had become highly politicized in Korea due to a number of energy related scandals and corruption charges during the previous President's administration. This led President Park to distance herself from the former government's energy policies, including with regards to energy diplomacy[312].

Now, according to the Korean Ministry of Foreign Affair (MOFA), in order to secure a stable supply of energy, enhancing national security, Korea has been strengthening international cooperation on energy issues, such as global energy security environment and global energy transition[313]. Korea also initiated bilateral and multilateral dialogues with the United States and Japan. In addition, MOFA has planned a series of 47 diplomatic missions in major energy-trading countries in the Middle East, Africa, South and Central America, and Eurasia[314].

3.6 Conclusions

In this chapter, I have focused on the Republic of Korea's main GHG emitting sector, energy. South Korea is a very energy-intensive country. Korea's main energy sources are fossil fuels and nuclear, while its renewable sources rate is vary low, between 7 and 8 percent. Apart from sector-specific policies contained in the broader GHG emissions reduction Roadmaps presented in Chapter Two, Korea has designed detailed energy plans.

311 Se Hyun Ahn, *Republic of Korea's Energy Security Conundrum: The Problems of Energy Mix and EnergyDiplomacy Deadlock*, in Journal of International and Area Studies, Vol. 22, No. 2 (2015), Institute of International Affairs, Graduate School of International Studies,Seoul National University, p. 83

312 Ibidem, p. 82

313 Ministry of Foreign Affairs, *Energy*, http://www.mofa.go.kr/eng/wpge/m_5657/contents.do (last visited on February 6th, 2020)

314 Ibidem

In Korea, the two pillars of the national energy strategies are Basic Energy Plans and Master Plans for Electricity Demand and Supply. The Basic Energy Plan represents the primary source of guidance on all areas pertaining to energy, including the definition of mid- to long-term sector-specific and local energy policies. The Master Plans for Electricity Demand and Supply provides the basic direction of power supply and demand, as well as a long-term prevision of power supply and demand, a plan for power installations, the management of power supply and demand and other related matters. As said before, Korea's main sources of energy are fossil fuels, in particular coal, and nuclear power. This, though, presents serious issues. With regards to nuclear power, after the Fukushima accident in 2011, concerns over risks of damage to nuclear power plants started to rise, increased by a 5.8 magnitude earthquake 2016, whose epicentre was only 28 km from the Wolsung nuclear power plant. To make matters worse, the density of nuclear power reactors is the highest in the world and main nuclear plants are near highly populated areas: for example, the population living within a 30-km radius of the nuclear power plants in Wolsung is 1.3 million people. This would mean that the effects of an accident would be grave. Fossil fuel-fired plants represent a problem because of the high levels of fine dust they produce. In response to these problems, the current Korean government, led by Moon Jae-in, launched the Renewable Energy Roadmap 3020. This roadmap pledged an increase in the renewable energy rate of the national energy mix from 7 percent to 20 percent by 2030 and to up to 35 percent in 2040. This would lead, according to the Roadmap, to a reduction of coal-fired power plants and an acceleration of the nuclear phase out. Although the 3020 Roadmap represents a partial answer to the country's energy-related problems and would help boost its GHG reduction efforts, the Korean government still has some obstacle to overcome in order to successfully implement it. First, although public consensus on the reduction of nuclear power has increased, many Koreans still believe nuclear power to be a sort of necessary evil. At present, nuclear phase-out is still a controversial issue and the Korean public opinion is split between those who oppose the government plan and those who support it. Another obstacle Korea faces in increasing its renewable-produced energy is that the cost of renewable energy and natural gas-fired power plants is, as of yet, much higher than bituminous coal-fired and nuclear power facilities. This, in turn, means that an increase in renewable energy sources would lead to a rise in electricity costs. One solution would be to incorporate in the tax on

electricity the environmental and social costs from fossil- and nuclear-based energy generation. Another solution would be the development of technological advancements that would produce efficiency improvements in the energy market with renewable energy gaining competitiveness.

As seen in Chapter One, the main actor and policy-driver on climate change-related issue is the government and this is true also for its energy policies. The Moon administration, though has tried to change the structure to a more decentralized one, where private entities and civil societies organizations take a more active role in designing and implementing energy projects, with particular regard to the use of renewable energy.

Linked to Korea's high dependency on nuclear power is the issue of radioactive waste management. As of now, South Korea does not have a clear national policy on nuclear waste management yet and takes a "wait & see" approach to high-level waste management, according to which nuclear waste is temporarily stored at each reactor site. Unfortunately, Korean authorities predict that storage facilities will reach their maximum capacity in a few years. Low-and-intermediate-level waste, generated in nuclear power plants are subjected to treatment processes such as volume reduction, stabilization, etc. at on-site treatment facilities, where they are also temporarily stored before being transported to the Wolsong Disposal Center (WLDC) for final disposal.

As seen above, in addition to being an energy-intensive society, Korea is also energy-poor which means the country has to import around 90 percent of its energy and energy sources. This opens the issue of energy security and energy diplomacy. After giving a definition of what these two concepts mean, I have presented Korea's main cooperation arena. North-East Asia. Until now regional cooperation has been mostly bilateral and even though NEA countries understand the need for more energy cooperation, there are still important political and social factors that prevent more multilateral efforts to be implemented. A step forward in this direction is represented by the launch of an Asian Super Grid project that has already been joined by China, South Korea, Russia, Japan and Mongolia. Another important energy cooperation arena for Asia and South Korea could be Europe. South Korea's main energy diplomacy objective is diversification of its energy import markets. Although under the previous administration energy diplomacy efforts had greatly decreased, the Moon government has tried to restore international cooperation on energy; in particular, it has initiated bilateral and multilateral dialogues with the United States and

Japan and planned a series of 47 diplomatic missions in major energy-trading countries in the Middle East, Africa, South and Central America, and Eurasia.

Conclusions

Before doing a final recap and drawing some conclusions, I want to point out a few facts. First, I am not an expert on South Korea or climate change, but merely a student of international relations. Also, this dissertation is not the result a on-field research. To create this thesis and reache the objective set in it I have analysed other researchers' works and articles, official reports, books and reported data and then I have made a summary of the points and notions I thought most relevant. Using these tools I have tried to give and overview of South Korea's mitigation policies and its efforts to reduce national GHG emissions. Therefore, it is possible I have not included every aspect of the climate change issue and debate both globally and in South Korea.

That being said, let us summarize briefly what has been presented in the previous chapters. The greatest challenge that today's international community has to face is climate change. In this fight South Korea holds a strange and unique position in that it is classified as a developing country, but its GHG emissions levels are similar to those of developed countries. This gives Korea the opportunity of playing a bridging role between these two groups. Because of these reasons, in this dissertation I have tried to present the main climate change mitigation policies in South Korea.

Since there is still some confusion about what is climate change, its causes and consequences and what can be done to stop this phenomenon from worsening, in the first part of Chapter One I have focused on the issue of climate change. Changes in climate have occured cyclically throughout time. Today's climate change, though, represents a threat because it is happening at an incredibly fast rate, due to an increase in GHG emissions in the atmosphere caused by human activity. Greenhouse gases emissions are an integral part of natural processes: they produce the greenhouse effect, which is the reason Earth is warm enough for life to exist. The higher levels of GHG emissions in the last decades have caused more heat to remain trapped inside the atmosphere, causing average temperatures to rapidly rise. This phenomenon is called global warming. This is starting to have a wide variety of negative consequences that will worsen over time, including melting of ice, increase in sea levels, worsening of water quality and a decrease in its supply, loss of biodiversity and damage to ecosystems. These in turn will affect human society: scarcity

of food and water, and an increase in the latter's pollution, coupled with a potential increase in diseases, will cause coflicts and alter the geopoltical balances and create more crises. Different groups of people will be affected in different ways. The more vulnerable will be the poor, older adults, young children, immigrants and indigenous people. States have two different solutions to face this threat: adaptation and mitigation. Adaptation strategies aim to reduce vulnerability to natural events, whereas mitigation strategies try to stop the advancement of global warming and climate change by reducing GHG levels in the atmosphere, by either reducing emissions or capturing greenhouse gases already released and storing them in underground sinks.

After this introduction on climate change I have briefly outlined the main steps in international cooperation efforts. The two main achievements were the Kyoto Protocol of 1997 and the Paris Agreement in 2015.

Finally, in the second part of the chapter I have focused on South Korea. After a brief general overview of the country's geography and socio-economic structure, I have presented Korea's international effort to fight climate change. In doing so, I have outlined Korea's unique position on the international stage: although it is recognized as a non-Annex I party under the UNFCCC regime, which is to say a developing country, Korea is also a member of the OECD and its GHG emissions level are the same as developed countries.

I them moved on to describe Korea's main internal actors on climate change. They can be divided into three categories: governmental organisations, business organisations and civil society organisations. I presented a study which had analysed these three goups and how they interact. The results showed that in Korea the government and its organs are the main climate change actors and climate change policies drivers. They interact mainly within themsemlves and with business organisations. This is due to the fact that civil society organisations, though they sometimes have contacts with the other two gruops, tend to mostly interact within themselves.

In the final paragraph I have given a short presentation on South Korea's main adaptation strategies.

In Chapter Two I have concentated on GHG emissions reduction policies implemented by South Korea to comply with the Paris Agreement's goal of keeping a global temperature rise this century well below 2 °C above pre-industrial levels and to pursue efforts to limit

the temperature increase even further to 1.5 degrees Celsius.

Firstly, I have presented the Korean first Nationally Determined Contribution. In rhis document, required from all countries by the Paris Agreement, the Republic of Korea pledged to reduce GHG emissions by 37% by 2030 from BAU levels. In the same year, The South Korean Government had launched on the national scene its First Basic Plan for Climate Change Response, a comprehensive policy plan with medium and long-term strategies and specific action plans to combat climate change.

To drive the national efforts to reduce GHG emissions, the Korean Government has launched during the years a series of GHG Emissions Reductions Roadmaps, containing detailed expected reductions rates and possible general and sector-specific strategies to reach these goals. The first Roadmap was realesed in 2014 to comply with a 2009 pledge to reduce emissions levels by 30% from BAU in the year 2020. Then, in 2016 a new Greenhouse Gas Reduction Roadmap 2030 was released. It was a revision of the original 2014 map to honour Korea's pledges made in its NDC. Comparing the two roadmaps, it is clear that the new plan sets lower reduction rates in all sectors, with the exception of waste management. Finally, in 2018 a revised version of the original Roadmap 2030 was released. This new revision was caused by strong criticisms to the original version, accused of allocating a large portion of emissions reduction to overseas reductions without effectively mapping out specific action plans to this end. South Korea has also launched in January 2015 a national Emissions Trading System (also known as K-ETS). The Korea Emissions Trading Scheme (KETS) caps greenhouse gas (GHG) emissions from participants within the scheme and involves the issuance of a corresponding number of emission allowances. Participants must measure their annual emissions and surrender allowances to cover their emission responsibility. Participants that emit less than their allocation can sell their excess allowances, while those who do not have enough allowances to cover their annual emissions need to buy them. Another piece in Korea's mitigation strategy is the GHG & Energy Management Target, which has been operating since 2010. This program designates companies with large amount of GHG emission and energy consumption as the subject of the target management, then imposes them with reduction targets and verify and keep track of their performance.

After presenting these national mitigation strategies, I have analysed the contents of Korean Biennial Update Report and National Communication, two documents that

members of the United Nations Framework Convention on Climate Change have to submit regularly as reports on their mitigation efforts.

In the last part of the chapter I have analysed the reports and data collected by three online websites whose aim is to monitor progress in the fight against climate change (Climate Action Tracker, Climate Transparency and Climate Change Performance Index), to see whether Korean policies are effective. Unfortunately, the researches by Climate Action Tracker, CCPI and Climate Transparency have shown that the Republic of Korea's implemented plans and policies are not ambitious enough and fall short of the below 2°C aim, let alone the more stringent goal of 1.5°C. The only real sign of positive change comes from the energy sector, in particular with regards to the implementation and use of new renewable sources of energy.

In the last Chapter, I have focused on the Republic of Korea's main GHG emitting sector, energy. South Korea is a very energy-intensive country. Korea's main energy sources are fossil fuels and nuclear, while its renewable sources rate is vary low, around 7-8 percent. Apart from sector-specific policies contained in the broader GHG emissions reduction Roadmaps presented in Chapter Two, Korea has designed detailed energy plans. In Korea, the two pillars of the national energy strategies are Basic Energy Plans and Master Plans for Electricity Demand and Supply. The Basic Energy Plan represents the primary source of guidance on all areas pertaining to energy, including the definition of mid- to long-term sector-specific and local energy policies. The Master Plans for Electricity Demand and Supply provides the basic direction of power supply and demand, as well as a long-term prevision of power supply and demand, a plan for power installations, the management of power supply and demand and other related matters. As said before, Korea's main sources of energy are fossil fuels, in particular coal and oil, and nuclear power. This, though presents serious issues. With regards to nuclear power, after the Fukushima accident in 2011, concerns over risks of damage to nuclear power plants started to rise, increased by a local 5.8 magnitude earthquake in 2016, whose epicentre was only 28 km from the Wolsung nuclear power plant. To make matters worse, the density of nuclear power reactors is the highest in the world and many of South Korea's main nuclear plants are situated near highly populated areas. This means that the effects of an accident would be grave. Fossil fuel-fired plants represent a problem because of the high levels of fine dust they produce. In response to these problems, the current Korean government, led by Moon

Jae-in, launched the Renewable Energy Roadmap 3020. This roadmap pledged an increase in the renewable energy rate of the national energy mix from 7 percent to 20 percent by 2030 and to up to 35 percent in 2040. This would lead, according to the Roadmap, to a reduction of coal-fired power plants and an acceleration of the the nuclear phase out. Although the 3020 Roadmap represents a partial answer to the country's energy-related issue and would help boost its GHG reduction efforts, the Korean government still has some obstacle to overcome in order to successfully implement it. First, although public consensus on the reduction of nuclear power has increased, many Koreans still believe nuclear power to be a sort of necessary evil. At present, nuclear phase-out is still a controversial issue and the Korean public opinion is split between those who oppose the government plan and those who support it. Another obstacle Korea faces in increasing its renewable-produced energy is that the cost of renewable energy and natural gas-fired power plants is, as yet, much higher than bituminous coal-fired and nuclear power facilities. This, in turn, means that an increase in renewable energy sources would lead to a rise in electricity costs. One solution would be to incorporate in the tax on electricity the environmental and social costs from fossil- and nuclear-based energy generation. Another solution would be the development of technological advancements that would produce efficiency improvements in the energy market with renewable energy gaining competitiveness.

As seen in Chapter One, in Korea, the main actor and policy-driver on climate change-related issues is the government and this is true also for its energy policies. Nonetheless, the Moon administration, has tried to change the policy creation structure to a more decentralized one, where private entities and civil societies organizations take a more active role in designing and implementing energy projects, with particular regard to the use of renewable energy.

Linked to Korea's high dependency on nuclear power is the issue of radioactive waste management. As of now, South Korea does not have a clear national policy on nuclear waste management yet and takes a “wait & see” approach to high-level waste management, according to which nuclear waste is temporarily stored at each reactor site. Unfortunately, Korean authorities predict that storage facilities will reach their maximum capacity in a few years. Low-and-intermediate-level waste, generated in nuclear power plants are subjected to treatment processes such as volume reduction, stabilization, etc. at on-site

treatment facilities, where they are also temporarily stored before being transported to the Wolsong Disposal Center (WLDC) for final disposal.

In Chapter Three we have also observed that, in addition to being an energy-intensive society, Korea is also energy-poor which means the country has to import around 90 percent of its energy and energy sources. This opens the issue of energy security and energy diplomacy. After giving a definition of what these two concepts mean, I have presented Korea's main cooperation arena, North-East Asia. Until now regional cooperation has been mostly bilateral and even though NEA countries understand the need for more energy cooperation, there are still important political and social factors that prevent more multilateral efforts to be implemented. A step forward in this direction is represented by the launch of an Asian Super Grid project that has already been joined by China, South Korea, Russia, Japan and Mongolia. Another important energy cooperation arena for Asia and South Korea could be Europe. Although under the previous administration energy diplomacy efforts had greatly decreased, the Moon government has tried to restore international cooperation on energy; in particular, it has initiated bilateral and multilateral dialogues with the United States and Japan and planned a series of diplomatic missions in major countries in the Middle East, Africa, South and Central America, and Eurasia.

In conclusion, from the brief history of multilateral climate negotiations we can evince that, even though the international community is willing to cooperate to face the climate change threat, there are still obstacles to a full global cooperation on this issue and, at least for now, individual interests, take precedence in each State's international strategy. This is also true for international cooperation on specific issues, for example energy security. Regarding this problem, countries agree on the need for mutual cooperation but as of now, this agreement has not led to real actions. Hence, to seriously face the climate change threat, countries need to put aside their differences and personal interests in order to create a strong international cooperation regime, both globally and regionally. Specifically with regards to South Korea, since it is one of the main GHG emitters the country's implemented emissions reduction plans play a great role in global efforts to reduce greenhouse gases. The problem that emerges is that, even though the Republic of South Korea has developed various detailed plans and strategies to reduce its GHG emissions levels, according to experts the country's efforts are not ambitious enough and if the

country doesn't give itself more stringent GHG reduction goals, it will not reach the below 2°C increase objective. Another problem Korea has had to face, due to the State's centralised structure, is a difficulty to involve more in its mitigation policies groups and entities not directly linked to the government, which has remained for many years the main policy driver and promoter. Things have luckily started to change under the Moon Jae-in administration, elected in 2017. First, the new government has pledged to increase the share of renewable energy in the national energy mix considerably in next years, while at the same time reducing the country's dependency on fossil fuel and moving toward a complete nuclear phase out. Experts believe this is the only real positive change in South Korea's mitigation effort. The new government is also trying to move away from the historical centralised structure of Korea and give more space and power of initiative to local authorities, civil society organisations and private entities in the implementation of new mitigation plans and projects. All these promising changes will hopefully enhance the national contribution of South Korea to global mitigation efforts.

List of Abbreviations

AEPC= Atomic Energy Promotion Commission

APEC= Asia-Pacific Economic Cooperation

ASEAN= Association of Southeast Asia Nations

ASG= Asian Super Grid Project

BO= business organisation

BTA= bilateral trade agreement

CAT= Climate Action Tracker

CCPI= Climate Change Performance Index

CCS= carbon capture and storage

CFC= chlorofluorocarbon

CH4= methane

CO2= carbon dioxide

COP= Conference of the Parties

CSO= civil society organisation

ETS= Emissions Trading System

EU= European Union

EU-KOR= Europe-Korea Climate Action

EU ETS= European Union Emissions Trading System

GGGI= Global Green Growth Institute

GHG= greenhouse gases

GO= government organisation

GWh= gigawatt per hour

HLW= high-level waste

INDC= intended nationally determined contribution (also known simply as NDC)

ILW= intermediate-level waste

IPCC= Intergovernmental Panel on Climate Climate Change

K-ETS= Korean Emissions Trading System

KEA= Korea Energy Agency

KHNP= Korean Hydro & Nuclear Power Corporation

KORAD= Korea Radioactive Waste Agency

KWh= kilowatt per hour

LLW= low-level waste

LNG= liquefied natural gas

ME= Ministry of Environment

MKE= Ministry of Knowledge and Economy

MtCO2eq= metric tonne of carbon dioxide equivalent (sometimes found simply as tCO2eq or CO2eq)

N2O= nitrous oxide

NEA= Nuclear Energy Agency - Korea

NGO= non-governmental organisation

NSA= Nuclear Safety Act

OECD= Organisation for Economic Cooperation and Development

P4G= Partnering for Green Growth and the Global Goals 2030

PCGG= Presidential Committee on Green Growth

PFC= perfluorocarbon

PTA= preferential trade agreement

PJ= Petajoule

ROK= Republic of Korea

RTA= regional trade agreement

SDG= Sustainable development goal

SF6= sulfur exafluoride

SNF= spent nuclear fuel

TOE= tonne of oil equivalent

TPES= total primary energy supply

UN= United Nations

UNEP= United Nations Environment Programme

UNFCCC= United Nations Framework Convention on Climate Change

VLLW= very low-level waste

WMO= World Meteorological Organisation

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