NORWAY'S FAIR SHARE
OF MEETING THE PARIS AGREEMENT

Naturvernforbundet
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Study for Norwegian Church Aid, Stockholm Environment Institute,
Rainforest Foundation Norway, Friends of the Earth Norway (NNV)
and the Norwegian Forum for Development and Environment (ForUM)

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Front page photo: Solar panels in Timbuktu, Mali.
Photo: Greg Roland Buick/Norwegian Church Aid.

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Flodding in Vietnam.
Photo: Ingunn Gihle/Norwegian Church Aid

FORORD

Mange fikk øynene opp for klimaendringenes dødelige konsekvenser i 2017. Samtidig som orkanene i Karibia skapte store overskrifter, gikk verden gjennom utallige andre klimarelaterte katastrofer det samme året. Sørøst-Asia opplevde en flom som rammet 40 millioner mennesker. Det er et omfang det er vanskelig å forstå de fulle konsekvensene av. I tillegg så vi en tørke i Øst-Afrika som gjorde 20 millioner mennesker avhengig av nødhjelp, og som ble omtalt som den verste humanitære katastrofen i FNs historie. Sierra Leone, Kongo, Nepal, India, USA, Australia og mange land i Sør-Europa ble også rammet av en rekke ulike klimarelaterte katastrofer.

Og det er én ting går igjen: Det er normalt de fattigste og mest marginaliserte menneskene som er mest utsatt, og som blir hardest rammet, til tross for at verdens rike land i all hovedsak står bak klimaendringene. Denne urettferdigheten er uholdbar. Spørsmålene vi da sitter med, er: «Hva er Norges ansvar?» og «Hvor stor del av løsningen er det rettferdig at Norge bidrar med?». Med denne rapporten ønsker vi å bidra til å svare på disse vanskelige og kompliserte spørsmålene.

For å gi et svar bruker denne rapporten et rammeverk som tar utgangspunkt i hvor mye klimagasser ulike land har sluppet ut fram til nå, og hvor stor økonomisk kapasitet de har til å bidra med løsningene på klimakrisen. Ut ifra disse to kriteriene kan vi regne på Norges rettferdige andel av den globale klimainnsatsen. Norge bidrar med en del gode tiltak med god klimaeffekt, men som rapporten viser, både kan vi og må vi gjøre langt mer. Konklusjonene tilsier at Norge har et mye større ansvar enn hva vår befolkning skulle tilsi, og at Norge i dag gjør altfor lite.

Norge har kun 0,07 prosent av verdens befolkning. Rapporten kommer derimot fram til at vi må bidra med kutt av klimagassutslippene tilsvarende 0,65 prosent av verdens totale kutt. Med andre ord har vi et ansvar som er nesten ti ganger større enn folketallet vårt skulle tilsi.

Norges utslipp av klimagasser har økt med 3 prosent siden 1990. Til sammenligning har Sverige kuttet mer enn 25 prosent av sine utslipp over den samme tidsperioden. Denne rapporten slår derimot fast at vårt ansvar er så stort at det overgår det vi har mulighet til å kutte på hjemmebane. Norge er derfor nødt til å finansiere store utslippskutt i land som har mindre ansvar for klimakrisen enn hva vi selv har, i tillegg til å kutte raskt i våre egne utslipp.

For at Norge skal ta sin rettferdige andel av den nødvendige innsatsen, kreves en langt mer ambisiøs norsk klimapolitikk enn den vi fører i dag. De fire undertegnede organisasjonene utfordrer derfor den norske regjeringen til å ta initiativ til langt høyere utslippskutt i Norge. Rapporten skisserer at et mål om minst 53 prosent kutt innen 2030 vil være et viktig bidrag. I tillegg må Norge bevilge betydelig mer til finansiering av både utslippskutt og klimatilpasning i andre land. Rapporten anslår opp mot 50 milliarder kroner i året til globale utslippskutt og 15 milliarder til tilpasning. På den måten kan Norge gi et rettferdig bidrag til den globale løsningen.

Det er fortsatt mulig å holde den globale oppvarmingen til 1,5°C. Denne muligheten er derimot borte om bare noen få år. Vi, med vår rikdom, har en unik mulighet til å ta vår rettferdige andel. Norske politikere må være sitt ansvar bevisst og handle deretter.

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Sprout in a field in East Hararghe, during drought in Ethiopia.
Photo: Håvard Bjelland/Norwegian Church Aid

SAMMENDRAG

Hovedresultater	
Norges totale ansvar for utslippskutt innen 2030, sammenlignet med 1990-nivå	430 %
Norges minimum nasjonale utslippskutt innen 2030, sammenlignet med 1990-nivå	53 %
Norges andel av klimafinansiering til internasjonale utslippskutt	50 milliarder kroner i året
Norges andel av klimafinansiering til klimatilpasning	15 milliarder kroner i året

Rapporten «Norway's Fair Share of meeting the Paris agreement» presenterer en utredning av hva som er Norges rettferdige andel av de globale utslippskuttene som er nødvendige for å begrense global oppvarming til 1,5°C over førindustrielt nivå. I tillegg beregner rapporten Norges rettferdige andel av kostnadene for at utviklingsland skal få tilpasse seg til et endret klima, som Parisavtalen forplikter oss å bidra til.

Dette gjøres ved å bruke rammeverket «Climate Equity Reference Project» (CERP), som er utviklet av Stockholm Environment Institute og EcoEquity. Å fordele den nødvendige innsatsen mellom land når det kommer til kampen for å stoppe klimaendringene, er en vanskelig oppgave. Ved å ta CERP-rammeverket i bruk er det imidlertid mulig å komme fram til en rettferdig fordeling av klimainnsatsen som trengs, samtidig som behovet for utvikling for verdens fattige ivaretas. Dette gjøres ved å legge til grunn to grunnleggende prinsipper:

1. at landene har ulikt ansvar for klimakrisen,

2. at landene har ulik kapasitet til å bidra til å løse klimakrisen.

Disse kriteriene bygger på prinsippene om felles, men differensiert ansvar og respektiv kapasitet, som er prinsipper landene har blitt enige om internasjonalt, uttrykt i blant annet erklæringen fra Rio-konferansen i 1992 og i FNs rammekonvensjon om klimaendringer. Selv om det er enighet om disse prinsippene globalt, vektlegges de i praksis ofte forskjellig av ulike aktører. Operasjonaliseringen av ansvar og kapasitet har stor betydning for hvordan byrdene fordeles mellom rike og fattige land, og er således et vanskelig og omdiskutert spørsmål. CERP-rammeverket presenterer en måte å operasjonalisere disse prinsippene på som tar hensyn til at en rettferdig løsning på klimaproblemet også må gi rom til utvikling for verdens fattige.

Målet om maksimalt 1,5°C global oppvarming er lagt til grunn fordi det er det man i Parisavtalen har blitt enige om å begrense oppvarmingen til. I tillegg vil vi da kunne unngå noen av de verste effektene av klimaendringene. Samtidig ser vi konsekvensene allerede. 2017 blir for mange året da de virkelig fikk øynene opp for hvor ødeleggende og dødelig klimaendringene kan være med flom i Sørøst-Asia og tørke i Nordøst-Afrika, som rammet til sammen 60 millioner mennesker. Samtidig så vi langvarig tørke i California og hetebølger i Sør-Europa, som tok liv. Rapporten legger derfor til grunn en utslippsbane som med 67 prosent sannsynlighet vil holde den globale oppvarmingen under 1,5°C. Denne utslippsbanen viser at det er mulig å oppnå de nødvendige kuttene som gir oss en god sjanse til å klare dette, men det krever en umiddelbar global innsats.

Gjennom CERP-rammeverket utledes en rettferdig fordeling av den nødvendige globale klimainnsatsen, og Norges andel av den, ved å beregne landenes historiske ansvar for klimakrisen og deres respektive kapasitet til å løse problemet.

Mens *kapasitet* tar utgangspunkt i landenes økonomi, beregnes *ansvar* ved å ta landenes akkumulerte utslipp siden 1990. Både ansvar og kapasitet er beregnet ved å utelukke den delen av økonomien (for kapasitet), og de klimagassutslipp (for ansvar), som kan tilskrives landets fattige – dvs. de som lever for under 20 dollar dagen. Begrunnelsen for det er at mennesker som lever i fattigdom, har sluppet ut mindre klimagasser som følge av lavere forbruk, og dermed har mindre ansvar, samt at de må bruke

1 Beløpet er justert for kjøpekraft (PPP). Grensen på 20 dollar dagen (7500 dollar i året) er satt betraktelig høyere enn de globale grensene for absolutt og ekstrem fattigdom (2 og 1 dollar dagen) for å tillate et rom for utvikling for fattige utover det disse minimumsgrensen tillater. Grensen tar dermed hensyn til fattigdom også i industrialiserte land.

sin økonomiske kapasitet på utvikling, og dermed ikke kan forventes å bidra like mye til den globale klimainnsatsen. Fattige land, og land med en stor fattig befolkning, har derfor både mindre ansvar for klimakrisen og mindre kapasitet til å løse den. På denne måten ivaretar rammeverket hensynet til utvikling for verdens fattige.

Rapporten presenterer på bakgrunn av dette tall for Norges ansvar og kapasitet, som viser hvor stor andel av den globale klimainnsatsen et land har. Siden Norge er et rikt og høyt utviklet land, samt har hatt relativt høye utslipp fra 1990, må vi bidra med en andel av innsatsen som langt overgår vår andel av verdens befolkning. Norges rettferdige andel av klimainnsatsen er altså større enn størrelsen på befolkningen skulle tilsi. Norges befolkning utgjør kun 0,07 prosent av verdens befolkning, men vårt kombinerte ansvar og kapasitet fram til 2030 utgjør 0,65 prosent av den totale globale innsatsen som er nødvendig.

Konklusjonen blir dermed at Norge innen 2030 må kutte sine utslipp med 233 millioner tonn CO2. Med andre ord: Norge må redusere sine utslipp med 430 prosent sammenlignet med 1900-nivået for å kutte i tråd med sin rettferdige andel. Dette synliggjør nødvendigheten av en kraftig oppskalert nasjonal og internasjonal klimainnsats fra Norges side.

Ettersom det ikke er mulig for Norge å kutte mer enn 100 prosent nasjonalt, og det i praksis heller ikke er mulig å kutte alle klimagassutslipp i landet, innebærer dette at Norge er nødt til å finansiere omfattende utslippskutt i andre land i tillegg til ambisiøse utslippskutt nasjonalt. I rapporten antydes det hva som kan utgjøre en mulig fordeling mellom nasjonale og internasjonale kutt, ved å legge til grunn at Norge skal kutte forholdsmessig like mye nasjonalt som alle andre land, sammenlignet med våre forventede utslipp hvis vi ikke kutter noe. Det gjør at Norge innen 2030 må kutte 53 prosent nasjonalt sammenlignet med 1990-nivået.

Om vi kutter 53 prosent nasjonalt innen 2030, gjenstår derimot nesten 200 millioner tonn CO2. I tillegg kommer derfor en omfattende finansiering av utslippskutt i andre land. Hvor mye det kommer til å koste, avhenger av prisen på utslippskuttene. Ved å gjøre dette gjennom utbygging av fornybar energi og dermed legge til grunn den globale kostnaden av å bygge ut den fornybare energien som trengs konkluderer rapporten med at Norges ansvar for klimakutt internasjonalt kan være oppimot 50 milliarder kroner i året. På toppen av dette kommer Norges ansvar med å støtte utviklingsland til å tilpasse seg de klimaendringene det allerede er for sent å stoppe. Norges andel av det globale tilpasningsbehovet kommer på oppimot 15 milliarder kroner i året.

Dette er mye penger, og det vil kreve mye av Norge som samfunn å kutte over halvparten av sine nasjonale utslipp innen 2030. Men skal vi få til en rettferdig klimaløsning, er dette del av svaret. Hvis Norge ikke tar sin rettmessige del av innsatsen, vil det falle på noen med mindre ansvar og mindre kapasitet. Dessuten er Norge et rikt land som har råd til å finansiere utslippskutt nasjonalt og internasjonalt i tråd med vårt ansvar og vår kapasitet. Norge har allerede lovet å bli klimanøytralt innen 2030. Denne rapporten viser at Norges rettferdige andel er betraktelig større enn det. Jo lenger norske politikere venter, jo vanskeligere og dyrere blir det. Klimakrisen krever ambisiøs og omfattende handling og politikere med vilje til å mobilisere våre økonomiske og teknologiske ressurser for å løse vår tids største utfordring.

Photo: Norwegian Church Aid

1. INTRODUCTION

Devastating hurricanes, floods, forest fires and droughts are becoming "the new normal" as global temperature rise exceeds 1 °C above preindustrial levels. Given the catastrophic impacts we are already seeing, a rise above 1.5 °C — let alone 2 °C or more — is terrifying to contemplate. Urgent action is needed at a global scale to avoid the worst impacts, for people and the planet. The Paris Agreement's keystone objective of pursuing efforts to limit warming to 1.5 °C is essential for catalyzing the rapid, large-scale global action that is now needed. But, already, many fear that it's only a false promise, a mere "aspirational goal." And this is exactly what it will turn out to be if there is no ramped-up ambition to back up Paris' objective.

Further, Paris' lack of binding commitments means that we are already facing an uphill battle. And of course the pledges that were tabled in Paris fall far short of the Agreement's stated temperature objectives. Crucially, the Agreement builds in a regular revisiting of these pledges, and commits Parties to a continual "ratcheting" or strengthening of pledges in order to bring them in line with the agreed objectives of the Agreement, including the temperature objectives, in an equitable manner. Given the insufficiency of the initial pledges, this ratcheting process is absolutely key to meeting the Agreement's temperature goals, and to its ultimate success.

Norway has established itself as a global leader in the climate policy domain. Its concerted efforts to mobilize climate finance (Government of Norway, 2016; WRI/ODI/CICERO, 2013) have made it one of the largest contributors of climate-related support to developing countries. Norway surpassed its emissions reduction target of the first Kyoto commitment period, and has pledged to be "carbon neutral" by 2030. Owing to this demonstrated commitment to climate action, Norway is broadly perceived on the global stage to be an exemplar of climate ambition.

However, Norway's recent course is less promising. Its emissions are currently 3 % above 1990 levels, far exceeding its pledged target of reducing by 30 % by 2020. Moreover, Norway's ambitiousness should be assessed not only in comparison with other countries', but in comparison with the requirements of science, and in a manner that fully recognizes Norway's position as an exceptionally wealthy country whose prosperity has derived in considerable part from the extraction of fossil fuels contributing to climate change.

In this report, Norwegian Church Aid, The Norwegian Forum for Development and Environment (ForUM), Rainforest Foundation, and Friends of the Earth Norway assess the mitigation pledge that Norway has put forward under the Paris Agreement, evaluating it in light of its fair share of the global climate effort. For this report, the assigning organizations have adopted the same fair shares framework used by a broad coalition of civil society organizations, the Civil Society Equity Review coalition, for their recent assessments of countries' climate action pledges (CSO Review, 2015; 2016; 2017). This approach, which is described further below, is particularly relevant to the political realities of equitable effort-sharing in that it recognizes not only the vast disparities of wealth and capacity among countries, but also of the disparities between individuals within countries.

The scientific limits

The first step is to place the pledges and the fair share discussion firmly in the context of climate science and the urgency of the climate challenge. This involves specifying as clearly as possible what is required to keep warming below 1.5 °C. To represent an ambitious and equitable future consistent with the 1.5 °C limit, we draw upon a global mitigation scenario analysis (Grübler et al. 2018) recently developed at the International Institute for Applied Systems Analysis (IIASA). We have selected this scenario because it explicitly takes the universal attainment of a "decent living standard" as a design criterion and is therefore suitable for an analysis that foregrounds the developmental needs of the world's poorest and most vulnerable people in the context of climate action.

IIASA's pathway, which it refers to as the Low Energy Demand (LED) pathway, highlights and emphasizes major trends in energy demand that are already observable today and that are expected to continue and intensify, for example, urbanization, digitalization, decentralization of the

2 Whether this is truly "new and additional" (as, under the UNFCCC, developed country contributions are required to be) is a matter of debate. Members of Norway's civil society have argued that these contributions are part of the long-standing commitment of Norway to direct 1 % of gross domestic product toward overseas development assistance.
3 This pledge is offered conditionally, "as part of an ambitious global climate agreement in which other developed countries also take on extensive obligations, Norway will have a binding target for carbon neutrality by 2030 at the latest."

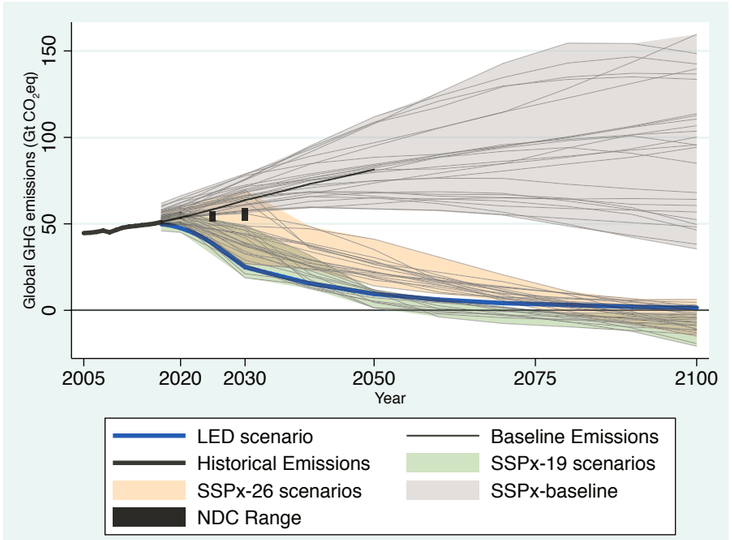

Figure 1. LED Pathway (blue), showing emissions rapidly peaking globally (by 2020), declining 80 % by 2050 and toward zero by the century's end; the baseline emissions projections used in this study (black solid line to 2030), in the context of the 1.5°C consistent scenarios (N=13, green area) of recent SSP studies (Rogelj et al. 2018), as well 2 °C consistent pathways (N=19, orange area) and baseline projections (N=26, grey area) of the mainstream SSP models (IIASA 2016). The figure also shows the possible range of emissions resulting from current climate action pledges (NDCs) under the Paris Agreement (black boxes).

energy system, shift from ownership-based to use-based consumption of services and the sharing economy, device convergence, and the emergence of a circular economy. These trends, together with other substantial increases in energy efficiency across all sectors, lead to energy demand being very low in the future (reaching 42% below 2020 levels in 2050), despite population growth and a global increase in end use energy services, such as thermally comfortable living space, food consumed per person, or the number of person-kilometres travelled. In the LED scenario, the energy system that satisfies this low energy demand decarbonizes quickly, as the shrinking of the global energy system provides "breathing room" for supply-side decarbonization and facilitates retirement of fossil-based generation.

Because of these features, the scenario can also satisfy the energy need without having to presuppose the availability in the future of large volumes of negative emissions, for example through large-scale bioenergy with CCS (BECCS), as assumed by many other ostensible 1.5 °C scenarios. As a result, the LED scenario relies on no negative emissions technologies (NETs, or CDR, for Carbon Dioxide Removal, including BECCS), although the global forest sink is enhanced significantly due to reduced competition of bioenergy cropland and pastures with forests.

Compared to current (2016) global greenhouse gas emissions of about 50 GtCO2eq (Le Quéré et al. 2018, Gütschow et al. 2018), the LED scenario requires very stringent reductions, eliminating half of current emissions by 2030 (reaching 25 GtCO2eq), only about 10 GtCO2eq in 2050, and a mere 1.5 GtCO2eq, mainly for agriculture, in 2100.

As a result, the scenario leads to an ambitious global emissions pathway that does not rely on controversial negative emission technologies. However, though it is an ambitious pathway, it cannot be taken as one that ensures that warming will remain below 1.5 °C. The inherent complexity in the global carbon cycle, along with our incomplete understanding of the climate system means that the climate system may be more sensitive to our emissions than our current understanding would suggest. Accounting for some of these uncertainties (the "known unknowns"), it is estimated that even this ambitious path would pose approximately a one-third chance of temperatures in 2100 being above 1.5 °C, and approximately one-half chance that temperatures will overshoot 1.5 °C at some point during the 21st century. Clearly, further delay, or less ambitious reductions will quickly increase the risk of greater warming, including rising the chance of exceeding 1.5 °C.

Figure 1 above shows the LED 1.5 °C Pathway, with emissions rapidly peaking globally (by 2020), declining 80 % by 2050 and essentially to zero by the century's end. Figure 1 shows the LED pathway in the context of a suite of other mainstream 1.5 °C and 2 °C pathways (Rogelj et al. 2018, IIASA 2016), most of which assume the deployment of substantial amounts of negative emissions technology, a feature which the LED pathway does not share. Nonetheless, it is apparent that the LED pathway chosen here, is among the more stringent of the 1.5 °C-consistent pathways. Additionally, Figure 1 also shows an ensemble of baseline scenarios from the same suite of pathways studies (SSPx-baselines), along with the baseline used in this analysis (see note 4 for details), highlighting that the specific baseline used here is well within the range of baseline scenarios of the relevant literature.

Zooming in, and excluding emissions from Land Use, Land Use Change and Forestry (LULUCF) , Figure 2a shows that by 2030 the world will need to have reduced GHG emissions by just over 36 GtCO2eq compared to the current global emission trends. This amount of mitigation greatly exceeds – by more than five-fold – the mitigation that has so far been pledged under the Paris NDCs (UNFCCC 2016). The fundamental question of equitable sharing of the global climate effort can then be posed as follows: what share of the required global effort should each country contribute to shift the world from its current pathway to a climate-safe pathway? In terms of the required mitigation effort, this is graphically represented in Figure 2: the widening orange area in the left panel depicts the global mitigation gap over time – the amount of mitigation needed to reduce emissions from the world's rising emission trend to the 1.5 °C LED pathway. The right panel illustrates how this widening mitigation gap might be divided into national shares of the required mitigation effort. The question is then, what is a fair way to share this effort?

In the following section we present the core equity principles that bear directly on this question of how this mitigation effort might be shared fairly, and present the approach that is taken here to assess Norway's fair share. It is important to stress that equity refers not only to the mitigation challenge, but also to adaptation, and to loss and damage as well. In fact, these challenges may be greater than the challenge of mitigation itself, and a global response will only be seen as fair if efforts on all sides are shared fairly. We return to this below.

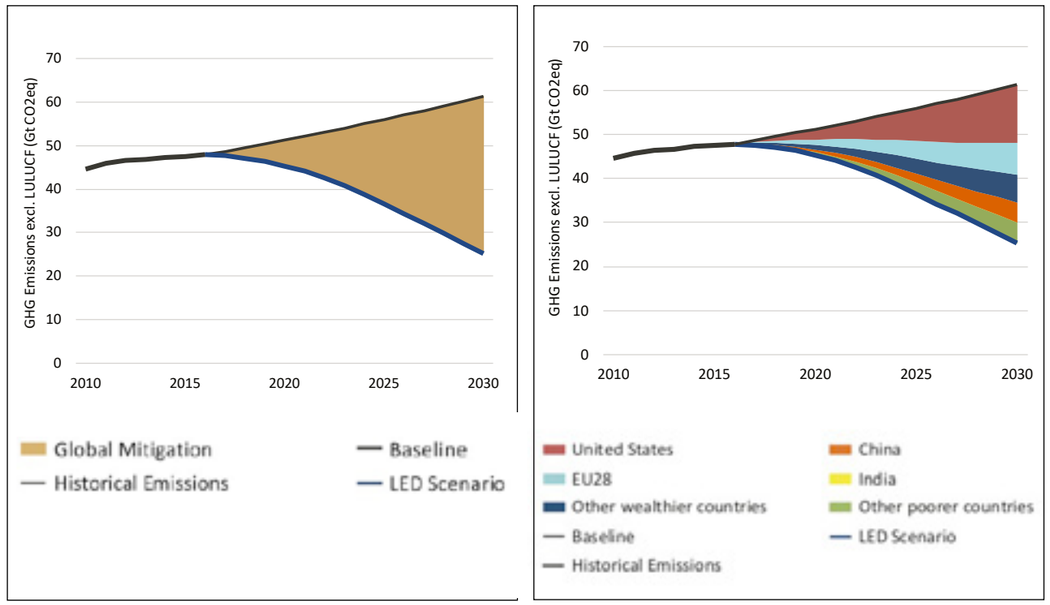

Figure 2: a. LED Pathway and baseline , showing necessary global mitigation (orange shading). b. LED Pathway and baseline, showing necessary global mitigation divided into national shares of the selected countries and groups

4 Global mitigation pathways, as the LED scenario pathway shown in Figure 1, typically include emissions from all sources. However, there is a large degree of uncertainty with regards to LULUCF emissions, and wealthy countries, including Norway, have written themselves emissions accounting rules for these emissions that even further obscure the true scale of emissions, and instead give themselves generous emissions credits from this sector. For these reasons, the following analysis exclude emissions from LULUCF, even though those emissions, especially emissions from deforestation and forest degradation, also need to be addressed in order to manage the climate crisis.

5 Our baseline emissions are based on GDP projections from the IMF's World Economic Outlook (to 2022) and IPCC AR5 Scenario Database (for 2023-2030) combined with the median carbon intensity changes modelled in the EMF27-Base-FullTech scenario from the IPCC AR5 Scenario Database. For more detailed information see https://climateequityreference.org/calculator-information/the-climate-equity-reference-calculator-database

Gerbile village has gone through both drought and flooding. Ethiopia, Somali Region.
Photo: Håvard Bjelland/ Norwegian Church Aid

2.THE CONVENTION'S CORE EQUITY PRINCIPLES

Equity principles and indicators

Climate change is the largest and most difficult commons problem that humanity has ever faced, and it will not be solved without prolonged and robust cooperation across the world's vastly disparate nations. Equity matters, then, not only because it is a good in itself but also because it is the key to cooperation. As the IPCC highlighted in its 5th Assessment Report's Summary for Policy Makers, "outcomes seen as equitable can lead to more effective cooperation" (IPCC 2014, p. 5).

The purpose of this report is to quantitatively assess Norway's fair contribution to that global cooperation. Defining and quantifying equity is challenging, of course. It is an inherently and irreducibly value-laden notion, one that cannot be uniquely and objectively specified. While there is certainly room for discussion about the precise definition and quantification of fair shares, equity is hardly a mere matter of opinion. Indeed, enough can be said about equity based on internationally agreed and virtually universal ethical principles to make an analysis of a country's fair share both illuminating and politically useful.

First, to understand the problem of equitable action within a world of disparities, it is useful to go back to the UN Climate Convention's core consensus on equity. As noted in the Principles (Article 3.1) of the UNFCCC,

"The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities."

This echoes the more explicit text of the Rio Declaration, agreed among Parties at the same 1992 Earth Summit in Rio de Janeiro as the UNFCCC, which reads:

"In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit of sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command." [Principle 7, Rio Declaration 1992]

The Rio Declaration is helpfully explicit about the relationship between the phrase "common but differentiated responsibilities" and ethical principles suggesting that countries' contribution to addressing global problems should be in accordance with their contribution to the problem (Responsibility) and their capabilities to solve it (Capacity). These two principles should be quite familiar, as they strongly echo how individual polities deal with ethical challenges: members of society are expected to take responsibility for their messes, and when public costs need to be shared, tax systems invariably require wealthier members to contribute more than poorer members.

A third critical principle is the Right to Development. As stated in the 1986 United Nations Declaration on the Right to Development:

"The right to development is an inalienable human right by virtue of which every human person and all peoples are entitled to participate in, contribute to, and enjoy economic, social, cultural and political development, in which all human rights and fundamental freedoms can be fully realized." [Article 1.1, Declaration on the Right to Development]

The Rio Declaration situates this fundamental right in the context of equity and sustainability, stating: "The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations." [Principle 3, Rio Declaration].

In the context of the climate challenge, these three core equity principles can be expressed as follows:

- **Capacity** implies that those who have greater capacity to deal with climate change should contribute more to solving it, all else being equal.

- **Responsibility implies** that those who have greater responsibility for causing climate change should contribute more to solving it, all else being equal.

- **Right to Sustainable Development** implies that our global response to climate change – mitigation, adaptation, and addressing loss and damage – should be undertaken in a manner that protects human rights, fundamental freedoms, and enables equitable and sustainable development.

While different countries may never precisely agree on an exact formulaic definition of these principles, it is indeed possible to represent these principles as quantified indicators. Capacity has typically been expressed straightforwardly in financial terms. This has become customary in discussions of equitable effort-sharing not necessarily be-

cause financial income is the only relevant and important type of capacity for dealing with climate change, but because it is extremely highly correlated with the other types of capacity (technological capacity, institutional capacity, etc.) that are also important. Just as income is typically considered in a progressive manner in national tax policy – to differentiate a dollar earned by a poor person from one earned by a rich person – it can analogously be defined in a progressive manner for the purposes of defining national Capacity. A straightforward method for doing this is to define an income threshold below which income does not count toward Capacity. This is precisely analogous to the "0% tax bracket" that exists in nearly all national tax statutes, whereby earnings below a specified threshold do not count toward taxable income, i.e., do not count when assessing a person's financial "capacity" to be legitimately drawn from for the funding of public goods. Similarly, a higher income level can also be defined at which income counts most heavily toward national capacity, analogous to the maximum tax bracket. Between the two income levels, income increasingly counts toward the calculation of a country's capacity. This is a very simple, but quite useful, way to define an indicator for national Capacity, and it is compelling because it is so similar to how countries have typically drawn on the capacity principle as the basis for national tax policy. When defining an indicator of capacity, the key question is how progressively it should be defined, i.e., how much more heavily should a dollar of income earned by a wealthy person count than a dollar earned by a poor person. We return to this question in the section below.

Responsibility can be straightforwardly represented by a quantitative indicator reflecting cumulative GHG emissions since some specified initial date, which directly reflects a nation's contribution to climate change. It can also be defined in a progressive manner, to distinguish emissions arising from basic survival activities from those associated with luxury consumption. Analogous to the definition of Capacity, a simple way to introduce this progressivity is to define a country's Responsibility in a manner that excludes emissions corresponding to consumption below a lower threshold, and counts more fully those emissions corresponding to consumption above an upper threshold.

The right to sustainable development is clearly complex and multi-dimensional, but in the limited context of fair effort-sharing in international climate cooperation, we take it to mean that efforts are shared among countries in a way that does not burden any country – and in particular those countries still struggling to attain basic developmental needs.

With the above discussion of equity principles and indicators in mind, the general fair shares framework underlying this analysis follows straightforwardly, as described in the following section.

> Drought in Ethiopia, Somali region.
Photo: Håvard Bjelland/ Norwegian Church Aid

3. WHAT IS NORWAY'S SHARE?

Fair effort-sharing

Fair effort-sharing entails dividing the total required effort associated with global climate mitigation among all countries in proportion to each country's share of the total global Responsibility and Capacity. This means that each country has a unique fair share that will change over time as it increases its relative proportion of cumulative global emissions and global income. In this report, Responsibility and Capacity have been weighted equally (simply averaging them together), reflecting the perspective of the assigning organizations that the two principles should count equally in determining a country's fair share. (Alternatively, one could in principle weight the two unequally, giving greater priority to either Capacity or Responsibility.)

While there are many details associated with using these indicators to explicitly quantify a country's Responsibility and Capacity, there are two key ethical choices to be made.

The first is the *historic* extent of Responsibility: from what "start date" should emissions be reckoned in the accounting of responsibility? Based on internal deliberations and discussions the assigning organizations has identified a start date for accounting for cumulative emissions as 1990. Other dates could be justified, such as 1970s, which reflects a period during which governments such as the United States were already issuing reports about climate change and the G7 was already highlighting climate change as a problem and seeking to prevent further increases of carbon dioxide in the atmosphere, or even 1850, which reflects a period during which fossil carbon emissions of industrializing countries became significant. The choice of 1990 is thus arguably a rather late date, reflecting a time frame during which countries were already in the process of negotiating an international climate agreement. Indeed, when the Convention was signed in 1992, the year 1990 was included as a contemporary reference point against which to measure developed countries' mitigation efforts by the year 2000. It was not intended as a reference point or start date for the concept of historical responsibility noted in its preamble. In legal terms, 1990 cannot be taken as the "ordinary meaning" of the term "historical emissions". But using 1990 serves to make a point: it defines Responsibility in a manner that is *generous* to nations that had already been fully industrialized and had undertaken much of their fossil fuel-intensive development prior to 1990, and yet, as we see below, it nevertheless leads to striking results showing the need for these countries, including Norway, to contribute much more to the global effort than they have so shown a willingness to commit.

The second key ethical choice is the relative capacity of poor people and wealthy people within each nation as discussed above. That is, to what extent should *progressivity* enter into our definition of Capacity?

For the analysis of Norway's fair share presented here, the assigning organizations elected to set a development threshold at a level modestly higher than a global poverty line, which is itself about US$16 per day per person (PPP adjusted , US(PPP)$2005). This is notably higher than the oft-referenced poverty line of US$1 or US$2 per day, which is more appropriately termed an "extreme poverty line" or a "destitution line". Rather, this figure derives from an empirical analysis of the income levels at which the classic plagues of poverty – malnutrition, high infant mortality, low educational attainment, high relative food expenditures – begin to disappear, or at least become exceptions to the rule. So, taking a figure of 25% above this global poverty line, these results assume a development threshold of US$20 per person per day (US$7,500 per person per year), a level which also happens to be consistent with a typical poverty line in a developed country.

The upper threshold, marking the income level above which income counts fully toward the calculation of a country's Capacity, is set at a level that generally reflects a lifestyle at which further income would be spent not on basic necessities. For this analysis, the upper threshold is set at US(MER)$100,000 per year. This figure seems quite con-

6 The lower threshold is adjusted according to Purchasing Power Parity (PPP) conversion rates, to reflect the different purchasing power of local currencies compared to their Market Exchange Rate (MER) conversion rates (that is, the normal exchange rates used in currency markets), particularly at low incomes where a smaller portion of goods is traded through international markets. The higher threshold is defined according to MER conversion rates, reflecting the fact that a higher proportion of goods is traded through international markets at higher incomes, as well as those products and technologies required for mitigation.

7 Lant Pritchett (2003; 2006) concluded that the use of this line "is justifiable, more consistent with international fairness, and is a better foundation for the World Bank's organizational mission of poverty reduction" and that "If the poverty line were defined as the level of income at which people typically achieve acceptable levels of the Millennium Development Goal indicators (such as universal primary school completion), it would be set at about [$16] per day."

8 The Norwegian bracket tax – a tax on gross salary and other personal income – has a highest income threshold of NOK 962,050, or about $US(2005)96,000. https://www.nordisketax.net/files/nor/eng/i07.asp .

9 The Climate Equity Reference Calculator is a creation of the Climate Equity Reference Project, which assisted in the production of this report. For more information, see http://climateequityreference.org

sistent with the Norwegian context, as it corresponds to the highest income threshold in the Norwegian "bracket tax" .

This analysis has been carried out using the online *Climate Equity Reference Calculator* (Kemp-Benedict et al. 2017). It allows users to define a wide range of "equity settings" relating to Responsibility and Capacity, to reflect the users' understanding of what constitutes fairness in the context of sharing the global climate change mitigation effort. For the purpose of this report, the assigning organizations chose as key equity parameters: a historic responsibility start date of 1990, progressivity determined by thresholds of US$(PPP)7,500 and $US(MER)100,000, and an equal weighting of Capacity and Responsibility. The Climate Equity Reference Calculator then uses these definitions, along with standard demographic and macroeconomic indicators (e.g., national population, GDP, Gini, carbon intensity) to transparently calculate national "fair shares" of the common global effort.

The key equity settings used in this report	
CAPACITY	
Lower income threshold ("development" threshold, below which per capita income does not count toward national capacity)	$USD 7,500/year
Upper income threshold ("luxury" threshold, above which income counts fully toward national capacity)	$USD 100,000/year
RESPONSIBILITY	
Historic responsibility starting year	1990
RELATIVE WEIGHTING OF CAPACITY AND RESPONSIBILITY	equal (50%-50%)

Results: Norway's fair share

Given that Norway is among the world's wealthiest countries, with a GDP per capita in 2018 of nearly US$75,000, compared to a global average of roughly US$10,000, it has a disproportionately high proportion of the world's Capacity. More precisely, its population is only 0.07% of the global total, whereas it has 1.1% of the global total Capacity as defined above. Its Responsibility is disproportionate as well, but less so, being 0.38% of the global total. Averaging the two, we see that Norway's combined Capacity and Responsibility comes to 0.74% of the global total in 2018. Projecting ahead to 2030, its combined Capacity and Responsibility comes to 0.65% of the global total. (The decline owes primarily to the relative more rapid increase in income and emissions in developing countries, and their correspondingly larger share of global Capacity and Responsibility).

With this figure in hand, and given the definition of Capacity and Responsibility laid out here, one finds that in 2030 Norway's fair share is 0.65% of the total required mitigation effort (about 36 GtCO2eq), or 233 MtCO2eq. This same calculation is performed for every year between 2018 to 2030, yielding a series of annual fair shares for Norway.

In relation to Norway's Capacity and Responsibility, this fair share is appropriate and proportionate, and if Norway were to undertake less mitigation, it would be under-performing relative to its share of the total global effort. If it were to undertake more, it could truly be considered a climate leader, setting an example for other nations in an ambitious global response.

In chapter 5, we discuss the practical meaning of Norway's fair share, and how it could be implemented.

4. INTERNATIONAL COMPARISON

As Figure 3 shows, Norway does have somewhat higher fair share than the other countries. Note that such comparisons are on a per capita basis, as it would be meaningless to compare countries of such vastly different size on an absolute basis. For example, China's fair share is markedly smaller than Norway's on a per capita basis, because of their considerably lower wealth and emissions, even though it is much larger on an absolute basis. More to the point, however, the US fair share is about 25% lower than Norway's, and the fair share of the OECD as a whole is approximately 50% lower. This owes overwhelmingly to Norway's greater wealth. Especially within an ethical framework in which the higher the income, the more it counts toward a nation's capacity Norway's prosperity translates into greater ethical responsibilities to the world (just as in typical taxation systems, with higher tax rates applied to higher marginal income). This is notable, and even if Norway's standing as a climate leader is assessed by comparing its efforts relative to other developed countries (rather than the actual demands of a 1.5°C pathway), it must be gauged in light of Norway's greater capacity and responsibility.

The countries' NDCs are also shown in Figure 3, expressed in tons of pledged mitigation below baseline, per capita. It is immediately apparent that Norway's NDC, and all the other developed countries, fall far short of matching their fair shares. China's NDC represents nearly 80% of its fair share, and India actually manages to exceed it.

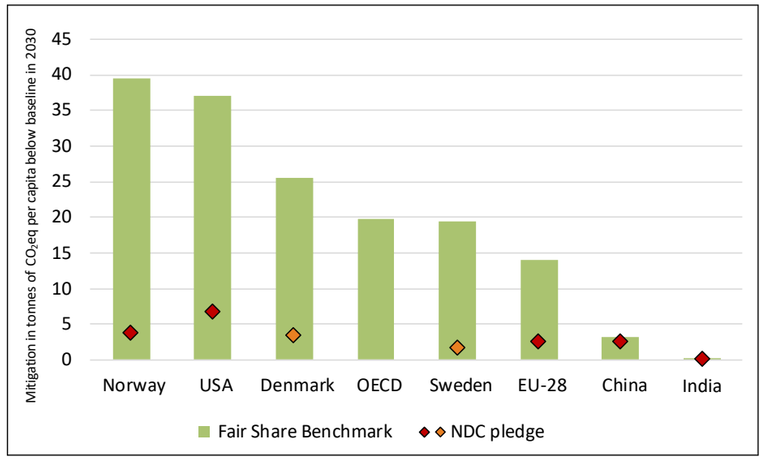

Figure 3. Norway's fair share compared with other countries or groupings, expressed on a per capita basis to provide a meaningful basis of comparison. For countries/groups that have an NDC, it is also shown (red diamond), for Sweden and Denmark, an estimate of the EU NDC's impact is shown (orange diamond).

	Norway	USA	Denmark	OECD	Sweden	EU-28	China	India
Fair Share (as mitigation in tonnes of CO2 per capita below baseline in 2030)	39.3	37.0	25.6	19.7	19.5	14.1	3.2	0.03
NDC pledge (as mitigation in tonnes of CO2 per capita below baseline in 2030)	3.8	6.8	3.5	n/a	1.8	2.6	2.5	0.16

10 As members of the EU, Sweden and Denmark do not have their own NDC under the Paris Agreement. Translation of the EU NDC is not straightforward since member states take targets of different stringency under the EU effort sharing agreement and since a large share of EU emissions are covered by the EU Emissions Trading Scheme, which makes it impossible to precisely assign reductions of these emissions to individual countries. As an indicative target, we have presented here the modelled emissions in 2030 under the EUCO27 scenario, which models the implementation of the EU's "40% below 1990" NDC with the auxiliary parameters agreed by EU leaders in October 2014 (43% reductions in EU-ETS sectors, 30% reduction in non-EU-ETS sectors, increase in renewables to 27% of EU energy consumption, 27% improvement in energy efficiency) (E3MLab & IIASA 2016).

5. THE DUAL NATURE OF NORWAY'S FAIR SHARE: DOMESTIC EFFORT & INTERNATIONAL SUPPORT

Fair share vs feasible reductions

Figure 4 shows Norway's emissions trend, or baseline, to 2030 (top line), and the time series of its growing fair share (orange wedge), increasing toward 233 MtCO2eq in 2030. As is immediately evident, the totality of Norway's fair share of global mitigation cannot possibly be undertaken domestically – Norway's emissions would need to be forced to zero within a few years, and somehow driven increasingly negative in the following years. In other words, Norway's fair share vastly exceeds its feasible domestic reduction opportunities.

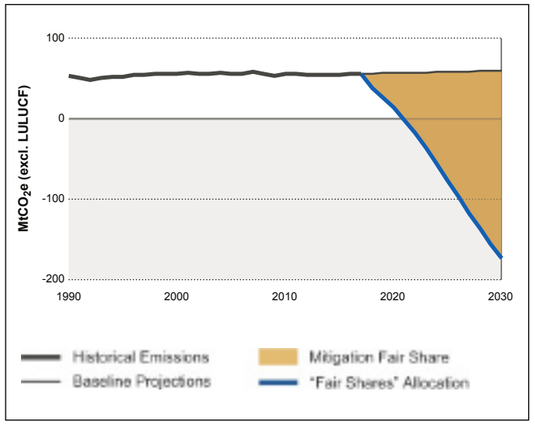

Figure 4. Norway's fair share of the global mitigation effort, growing toward 233 MtCO2eq in 2030, shown as reductions below Norway's domestic emissions. A large fraction of this effort would in fact need to be undertaken internationally, by providing financial and technological support.

What this clearly implies is that much of Norway's fair share of global mitigation simply cannot be undertaken through mitigation at home, and indeed it is unrealistic – and even counter-productive – to ask Norway to do so. Norway is not unique in this regard. It is just like other developed countries with high levels of Capacity and Responsibility, whose fair share of the global mitigation effort exceed their own domestic mitigation potential. Conversely, poorer developing countries (with relatively lower levels of Capacity and Responsibility) generally have fair shares of the mitigation effort that are smaller, and sometimes *much* smaller, than their domestic mitigation potential. However, if we are to keep warming below 1.5 °C, *all* available mitigation potential must be used, everywhere on the planet.

The only way to resolve this conundrum is through *international cooperation*. While it is pointless to demand that Norway make more domestic reductions than is feasible, it is entirely reasonable to require Norway to make extremely ambitious reductions domestically and to fulfil the portion of its fair share that it is unable to undertake at home by enabling – through financial and technological support – mitigation in other countries. Wealthier countries – *as an integral part of their fair share* – will thus provide the financial and technological means for poorer countries to exploit their full mitigation potential. Likewise, poorer countries will need to make effective use of this support to increase their domestic mitigation efforts to exploit their mitigation potential – *well beyond their fair share*. This additional mitigation would be undertaken in a manner consistent with their national sustainable development needs, and on the condition that support is forthcoming from wealthier countries. These additional reductions do not *offset* ambitious domestic reductions in wealthier countries, but are in *addition* to them.

It's important to recognize that there is an additional equity dimension beyond ensuring fair shares with necessary means of implementation. There is an inequity in requiring poor countries to reduce emissions beyond their fair shares because wealthier countries' disproportionate use of the carbon budget – even if they are provided with the means to do so. Poorer countries now have no choice but to forego the proven development pathways that wealthier countries have taken, and to shift to alternative pathways that are not fully proven, at an extraordinarily rapid pace, to help the world avoid catastrophic climate change. While this developmental shift is needed, there is still an injustice in requiring developing countries to work with a much narrower set of options on an extremely difficult timeline. This limits countries' opportunity to plan a just transition that can mitigate the hard trade-offs and protect workers, citizens and sectors against the upheaval that any major transformation involves. This challenging situation underscores the importance ensuring that wealthier countries provide international climate support in a manner that is predictable and reliable, so long-term planning is feasible for their poorer partners.

In Norway's case, how much of its fair share should be discharged through domestic mitigation, and how much through international cooperation? Figure 5 presents an indicative division of Norway's fair share into domestic and international portions. This division is approximate, as a more precise estimate would require an analysis of a cost-effective distribution of mitigation among all countries based on detailed, bottom-up, assessment of each country's domestic mitigation potential. It would require country-by-country assessment of renewables resources, efficiency potential, and unmet energy service needs, as well as projections of structural economic trends and techno-economic performance of mitigation technologies. Perhaps even more challenging, it would require confronting value-laden questions regarding the potential and need for shifts in consumption driven by lifestyle and behavioural shifts to reduce emissions, as well as an understanding of the transitional challenges confronting developing countries as they aim to rapidly shift developmental courses. Clearly, no such definitive analysis exists. We thus provide a rough estimate that serves as a helpful benchmark and signal for the general scale of domestic reductions that should be anticipated. This estimate is based on the simple assumption that national emissions in all countries should decline below national business-as-usual trends at a rate no lower than the aggregate global emissions drop, as determined by the overall global LED 1.5 °C Pathway, where emissions in 2030 (excluding land use) have fallen to 25.2 GtCO2eq, or 59% below baseline projections. Certainly, any

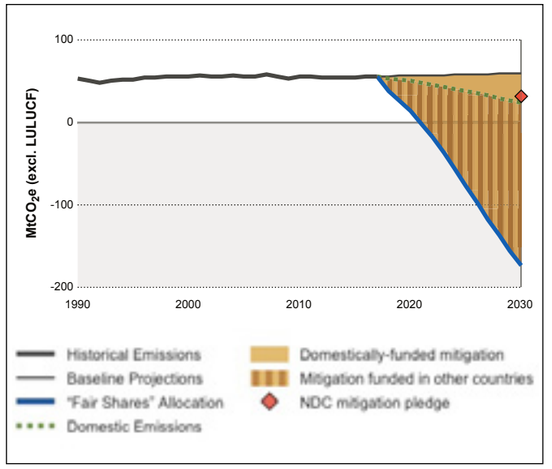

Figure 5. Norway's fair share, divided into a portion that could be undertaken domestically (yellow wedge) and a much larger portion (striped wedge) that would be undertaken through international support.

claim that Norway should be allowed to reduce emissions at a slower rate would have to be accompanied by a strong case that other nations should reduce their emissions at a quicker rate, along with the support to enable that to happen.

Applying the above approach, and obliging Norway to make domestic reductions of 59% below its projected 2030 emissions (again, as an absolute minimum) translates to reductions of no less than 35.2 MtCO2eq of mitigation effort relative to Norway's current baseline pathway, amounting to emissions in 2030 of no more than 24.6 MtCO2eq, which is 53% below 1990 levels. Clearly, in comparison even to this minimal target, Norway's current 2030 pledge of a 40% reduction is extremely weak.

Equally clearly, this domestic reduction leaves a large fraction of Norway's overall fair share of 233 MtCO2eq to be undertaken by supporting mitigation internationally. The domestic reduction amounts to 35.6 MtCO2eq, leaving 198 MtCO2eq to achieve through international support, more than five times as much as Norway's expected domestic reductions. Clearly, international support is an absolutely integral part of Norway's fair share, and cannot be

11 We make the assumption that renewable energy investments displace a mix of other capacity investments with a combined average carbon intensity comparable to a modern natural gas power plant. We adopt the IPCC carbon intensity coefficient of 0.404 MtCO2/TWh (IPCC 2014; p. 295), typical for a natural gas combined cycle power plant. Then, 198 MtCO2 of mitigation straightforwardly translates into 490 TWh of renewable generation displacing natural gas generation.

12 Given the comprehensive and far-reaching nature of the necessary transition and the unavoidable uncertainties associated with technological progress and future policy choices, there is no definitive, objective methodology for estimating the size of the required investment. Still, a sense of the scale is provided by the recent International Energy Agency / International Renewable Energy Agency (IEA/IRENA 2017) study Investment Needs for a Low-Carbon Energy System. The collaboration by the two organizations relied on two distinct analytical methodologies and modelling tools, yet came up with fairly consistent overall results looking at scenarios that rely on the same carbon budget aiming to keep warming below 2 °C with 66% likelihood. Over the period to 2050, the IEA finds that an increase in total investment of approximately 25% is required, equal to US$25 trillion, or an average of US$700 billion per year. The IRENA analysis finds an increase in total investment of approximately US$29 trillion is needed, averaging US$830 billion per year. It is important to note that these two studies were focused on energy-related emissions alone. When investments in other sectors of the economy are also taken into account, including waste, agriculture, and forestry, as well as in mitigation in all non-CO2 greenhouse gases, the total investment requirements will be higher. Also, the IEA/IRENA analysis was focused on a future in which warming is held below 2 °C with a 2in-3 chance. This is markedly less ambitious than the 1.5 °C future (or even a "well below 2 °C" future).

ignored, side-lined, postponed, or undervalued. To do so would be to fail to fulfil a major part of Norway's fair share.

For wealthier countries generally, the international dimension of their fair share is essential. As a group, OECD countries' domestic reductions below baseline would be 10 GtCO2eq in 2030, whereas their international support would amount to 17 GtCO2eq, together enabling them to fulfil their entire fair share of 27 GtCO2eq. In other words, while the domestic reductions in wealthier countries must be deep and ambitious, the mitigation achieved through international cooperation amounts to even more reductions. Specifically, it amounts to nearly one-half of global mitigation required, and is absolutely critical to putting the world's emissions on a 1.5 °C pathway.

Expressing the international support in terms of tons of CO2eq is helpfully concrete. It can be compared to a countries full fair share. It can be reckoned in terms of specific types of mitigation activities, such as generation from renewables, carbon sequestered by community-based forestry initiatives, and energy efficiency measures in buildings and industry.

But it is also helpful to get some sense of the scale of finance implied by the international component of a given country's fair share. To do this in the case of Norway, we present a simple and straightforward calculation as an illustration, taking as an example investments in renewable energy.

The first step is to note that the international mitigation support required from Norway, which reaches 198 MtCO2eq in 2030, could be met by investments in renewable energy (in addition to baseline investments in renewables) that rise to 490 TWh of new, additional renewable generation in 2030 . Second, we refer to a widely cited, comprehensive analysis by the International Energy Agency and the International Renewable Energy Agency (IEA/IRENA 2017) of a future scenario that reflects "an energy transition of exceptional scope, depth and speed" . We then find that Norway could provide the required 490 TWh of renewable electricity generation in 2030 with an incremental investment in additional renewable capacity reaching approximately US$13 billion in 2030 . Additional international support would be needed to meet its fair share in each other year, with the average annual investment over the period from now to 2030 being US$6.4 billion a year.

This could be low estimate of the average annual investment needs for renewable energy. First, it excludes the investments in transmission and distribution infrastructure needed to support the major expansion of renewables. Second, this estimate is based on a scenario that is less ambitious than the IIASA LED Pathway that we are considering here, and investment needs increase as level of ambition rises to account for needing to reach higher levels of grid integration of variable renewables (IRENA 2016).

Adaptation Finance

At the current 1 °C level of warming, the impacts are already severe, and they will grow only more so. Even if the warming were held below 1.5 °C, there will be an immense need for finance and support for adaptation (and for loss & damage), and it will be most acute in the developing world. Hurricane Matthew did enormous damage in south-eastern United States, but it pales before the material destruction and human suffering in Haiti. The year 2017 was followed by further extreme impacts, including more devastation in the Caribbean from exceedingly powerful hurricanes, from which it will take years to recover. Extreme heat waves across the globe (including Australia, Asia, Europe, the Americas) and caused countless heat-related deaths while fuelling devastating wildfires. In Bangladesh, India, and Nepal, unusually bad monsoon flooding directly affected 45 million people.

The true costs of adaptation are not well understood, and estimates routinely note the many types of climate impacts for which adaptation responses have not been assessed and costed. Because adaptation has consistently been subject to underinvestment relative to mitigation in international climate finance, the Paris Agreement calls for "the provision of scaled-up financial resources should aim to achieve a balance between mitigation and adaptation". Moreover, the inadequacies of private finance in dealing with adaptation suggest a necessarily large role for public finance (Pauw et al. 2016).

Over the years, estimates of total costs are getting more complete, but also more alarming. The 2014 Adaptation Gap Report (UNEP 2014) reported additional costs for all developing countries of US$150 billion per year by 2025/2030, and US$250 billion to US$500 billion per year by 2050 (for a scenario of 2 °C increase by 2050). Only two years later, these numbers had been superseded by the 2016 Adaptation Finance Gap Report (UNEP 2016),14 which estimates that by 2030, adaptation costs will reach US$140-300 billion annually, with the potential to be five times greater by 2050. This comes to US$700 billion to US$1.5 trillion annually, a bracing range. And, if the climate system were to cross critical tipping points, the costs would become incalculable.

Even then, the costs of climate change impacts are notoriously underestimated (see, e.g., Stoerk et al. 2018), and the costs of adapting to those impacts are likewise underestimated (Parry et al. 2009). The importance and cost of protecting natural ecosystems to preserve ecosystem services is extremely poorly understood and liable to be a large contributor to adaptation costs. Costs of social adaptation often assume an inappropriately optimistic projection of general investments in social development and infrastructure upgrading, without which adaptation costs (and unavoidable climate damage) will be much higher. The fact that climate impacts are regularly under-estimated suggests that the scale of required adaptation is mis-calibrated at an inappropriately low level.

In chapter 3, we have calculated that Norway's fair share of the global mitigation need in 2030 is 0.65%, given its combined Capacity and Responsibility. Just as we applied this figure to the global mitigation need above, we can also apply it to the adaptation finance need to determine Norway's fair share of this figure, accepting for the meantime that the adaptation costs are undoubtedly greatly underestimated. Hence, taking 0.65% of US$140 billion to US$300 billion, Norway can fairly be expected to provide an annual contribution of US$910 million to US$1.95 billion toward the global adaptation finance need by 2030.

Main results		
Norway's share of global capacity by 2030		1.1%
Norway's share of global responsibility by 2030		0.38%
Norway's combined share of global capacity and responsibility by 2030		0.65%
Norway's fair share of global mitigation in 2030	MtCO2 below baseline	233 MtCO2eq
	% below 1990	430%
• Norway's domestic emission reductions in 2030	MtCO2 below baseline	35.2 MtCO2eq
	% below 1990	53%
• Norway's international emission reductions in 2030	in MtCO2	198 MtCO2eq
	in TWh of renewables	490 TWh
	USD investment	$13 billion
Norway's fair share of international adaptation assistance in 2030	US$/year	$0.91 – 1.95 billion

The IEA/IRENA study allowed 790 GtCO2 for the energy sector alone, and another 90 GtCO2 for industry, for a total CO2 budget of 880 GtCO2 (over 2015 – 2100), which is well more than twice the budget available for a 1.5°C budget. A study by Rogelj et al. (2015) surveyed various modelling analysis of 1.5 °C and 2 ° pathways, and found that, overall, 1.5 °C-compliant pathways cost in the range of 1.5 to 2.1 times more costly than the 66% likely 2 °C pathways.

13 Determining the investment needs for the incremental generation in 2030 is achieved by taking the total additional investment in renewables up to 2030 (above the IEA/IRENA "New Policies" reference scenario) and assuming a projected 25 year technical lifetime of the renewable capital (typical for wind and solar). The amount of cumulative incremental investment (2016-2030) for renewable power capacity needed to produce this additional renewable generation is approximately US$5.6 trillion, according to the IEA/IRENA analysis, roughly 60% of which is investment in wind and solar PV, and the remainder in hydro, concentrating solar power, bioenergy, and geothermal. The IEA/IRENA scenario leads to incremental renewable electricity in 2030 of 8,300 TWh greater than the reference scenario. Taking the capital investment required for that year's generation as the simple straight-line (25 year) depreciation of the total incremental capital investment up to 2030, the required investment is US$27 million per TWh. For Norway, this implies that the international portion of its fair share, which we found to be 198 MtCO2eq, or 490 TWh if expressed in new renewable generation, could be met by providing supportive investments in renewables amounting to approximately US$13 billion. Note, this US$13 billion would be the total investment required to meet the international portion of Norway's 2030 fair share, and could in principle all be invested in 2030. But the real-world delays associated with project pipelines and investment decision-making suggests that it should be invested earlier in order to ensure that the necessary mitigation actions are realized in 2030 (or earlier).

14 Note, this would be the total investment required to ensure that Norway put the investments in place to meet the international portion of its fair share in 2030 through renewable energy generation in developing countries. Additional international support would be needed to meet its fair share in each other year, with the average annual investment over the period from now to 2030 being US$6.4 billion a year.

6. CONCLUSION

Enduring and effective cooperation across the world's nations – rich and poor – is the only way that the climate problem can be solved. That cooperation is only possible if it embodies equity at its very core, and sees all countries contributing their fair share of the transformative effort that climate protection requires. As Norway seeks to position itself as a climate leader, it is especially important that it champion an approach of both ambition and equity.

To do so means that Norway must act in accordance with the equity principles that are central to the UNFCCC – the virtually universally held principles of Capacity, Responsibility, and a Right to Sustainable Development. As a wealthy country that owes much of its prosperity to benefits of the fossil age, Norway has a clear role to play.

Norway has an ethical obligation to engage in deep mitigation domestically. Simultaneously, and no less importantly, Norway's fair share also includes providing financial and technological support to enable extensive mitigation in other countries.

In this report, a fair share has been calculated for Norway using the equity approach adopted by the Civil Society Equity Review coalition, and based on equity choices made by the assigning organizations. We find that Norway's fair share of the entire global mitigation effort is 0.65% based on its share of the world's Capacity and Responsibility, which translates to 233 $MtCO_2eq$.

Assuming that Norway must reduce its domestic emissions below its current baseline emissions trend no more slowly than the world as a whole, this means it must reduce emissions by at least 53 % relative to 1990 levels in 2030, compared to its current pledge of only 40 % reduction. This leaves a large portion, growing to roughly 200 $MtCO_2eq$ in 2030, of its fair share to undertake through international support in 2030.

Expressing this in terms of investments in renewable power, this reaches 490 TWh in 2030, which in turn would require investments in renewable installations growing to 2030 to enable this to occur, with an annual figure between now and 2030 of US$6.4 billion a year.

As for support for adaptation, a preliminary estimate of Norway's contribution can be derived from global estimates of adaptation costs to be between US$910 million and US$1.95 billion in 2030. However, given that adaptation costs disregard many dimensions of adaptation, it is likely greatly under-estimated. A substantially higher figure is more than justified as a proactive and precautionary approach to survival under a changing climate in the absence of a definitive calculation of adaptation costs.

It remains feasible to keep warming below 1.5 °C, but it will not be for long. Prompt and very ambitious action is needed. Norway is in a position to undertake its fair share of that action, and to set an example for other countries.

Najiba, 15 years old in front of a solar panel in Daikundi Province, Afghanistan.
Photo: Jim Holmes/Norwegian Church Aid

< **Drought in Alyu Abba Ankober, Ethiopia.**
Photo: Kristin Morseth/
Norwegian Church Aid

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