PUBLICATION 08/2014

NORWAY'S FAIR SHARE
of an ambitious climate effort

SEI STOCKHOLM ENVIRONMENT INSTITUTE

NORWEGIAN CHURCH AID
actalliance

Rapporten er skrevet av Stockholm Environment Institute (SEI) på bestilling fra Kirkens Nødhjelp.

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Kirkens Nødhjelp (KN) kjemper sammen med mennesker over hele verden for å avskaffe fattigdom og urettferdighet. Vi gir nødhjelp i katastrofer og jobber langsiktig for utvikling i lokalsamfunn. For å fjerne årsaker til fattigdom påvirker vi myndigheter, næringsliv og religiøse ledere. Vårt arbeid utføres uten intensjon om å endre menneskers religiøse tilhørighet.
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Stockholm Environment Institute (SEI) er et uavhengig internasjonalt forskningsinstitutt. SEI ble etablert av den svenske regjeringen i 1989, og har drevet med akademisk analyse innen miljø-, klima- og utviklingsspørsmål siden da.
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Synspunktene i denne studien representerer ikke nødvendigvis synspunktene til Kirkens Nødhjelp.

Forside:
Bilde 1: Kirkens Nødhjelp demonstrerer sammen med samarbeidspartnere i ACT Alliance under klimaforhandlingene i Cancun, Mexico, for å beholde klimafinansieringen i FN.
Fotograf: Silje Ander, Kirkens Nødhjelp.

Bilde 2: Tran Viet Dung, 45 arbeider i risåkeren sin i Hue-provinsen i Vietnam. Her dyrkes livsviktig ris. Landsbyen ligger i lagunen, et sted som er meget sårbart for oversvømmelser. Klimaendringene vil sannsynligvis føre til hyppigere og mer alvorlige oversvømmelser i fremtiden og derfor støtter Kirkens Nødhjelp ulike tilpasningsprosjekter for befolkningen, og vi har også bidratt med nødhjelp i flomsituasjoner. Familien Tran har fått støtte til å bygge et nytt og flomsikkert hus.
Fotograf: Linn Grøtberg, Kirkens Nødhjelp.

Publikasjonsår: 2014
Layout: Martin Berge, Kirkens Nødhjelp
Trykk: Allkopi

Rapporten kan lastes ned fra
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INNHOLDSFORTEGNELSE

FORORD: KLIMALØSNINGEN MÅ VÆRE RETTFERDIG

Vi ser det når det syklonen rammer Filippinene, når regnet uteblir i Kenya eller når flommen kommer til Mosambik. Kirkens Nødhjelps partnere over hele verden rapporterer om det samme: konsekvensene av klimaendringene er allerede i gang, og det er de fattige som rammes hardest. Ikke bare rammes fattige land hardere enn rike land, men i tillegg er det de fattigste i de fattige landene som rammes aller hardest. En selvforsynt bonde uten vanningsanlegg rammes hardere av tørke, og et hus i slummen står seg dårlig mot ekstremværet.

Samtidig vet vi at det er vi i den rike delen av verden som har sluppet ut det aller meste av klimagassene. Dette er både uholdbart og urettferdig. Derfor mener vi at de rike landene må ta hovedansvaret for å få på plass en robust klimaavtale som ikke bare forplikter til ambisiøse kutt i klimagassutslipp, men som også er rettferdig. Dette innebærer at rike land tar det aller meste av klimaansvaret.

Dessverre er klimaforhandlingene preget av stillstand. Samtidig er det blant aktørene en sterk bevissthet om at vi må handle nå. Dette er det store paradokset i kampen mot klimaendringene. Spørsmålet om hvor mye ansvar de ulike landene skal ta, altså hvor mye de skal kutte og hvor mye de skal betale, er det mest avgjørende spørsmålet i debatten.

Blir verdens land enige om dette, og setter ord til handling, løser vi klimakrisen.

Rammeverket som er brukt i denne rapporten tar utgangspunkt i hvor mye de ulike landene har sluppet ut av klimagasser og hvor stor økonomisk kapasitet de har. Disse to faktorene avgjør hvor stort klimaansvar hvert enkelt land har. Denne rapporten ser først og fremst på hva som er Norges rettmessige andel. Funnet er at våre historiske utslipp og vår rikdom tilsier at Norge må gjøre en mye større innsats for å få ned klimagassutslippene enn både dagens klimainnsats og størrelsen på befolkningen vår tilsier.

Mens vi har kun 0,07 % av verdens befolkning, finner rapporten at vi må sikre kutt av klimagassutslippene tilsvarende 0,84 % av verdens totale kutt. Klimaansvaret vårt er altså mer enn ti ganger så stort som befolkningen vår skulle tilsi. Dette gjør at Norge, *i tillegg* til å kutte betraktelig mer nasjonalt, må finansiere utslippskutt i andre land – land som ikke har et like stort ansvar som oss.

Som oljenasjon har Norge også et moralsk ansvar. Vi har tjent oss rike på eksport av olje og bygget opp verdens største statlige fond på disse midlene. Utvinningen og forbruket av denne oljen har bidratt til å øke konsentrasjonen av klimagasser i atmosfæren betraktelig. Slik har vi tjent oss rike på eksport av klimaendringer. Dette historiske ansvaret bør motivere oss til å ta en lederrolle internasjonalt i kampen for en rettferdig klimaavtale. Å anerkjenne hvor stort ansvaret vårt er, og innrette norsk politikk deretter, er et avgjørende steg på veien.

Rapportens kanskje viktigste budskap er følgende: Det er mulig å finne en rettferdig løsning på klimakrisen. Vi, med vår enorme rikdom, har mulighet til å ta vår rettferdige andel av den globale innsatsen. Men jo lenger politikerne våre nøler, desto større blir jobben.

Hvis Norge tar sin rettmessige andel av verdens klimagassutslipp, kan vi bli en modell for hvordan byrdefordelingen må skje for å få stanset klimaendringene. Det krever en langt mer ambisiøs norsk klimapolitikk enn den vi fører i dag. Kirkens Nødhjelp utfordrer derfor den norske regjeringen til å ta initiativ til langt høyere utslippskutt i Norge. Et viktig bidrag fra norske politikere kan være å sette mål om 50% innenlandske kutt innen 2030, slik rapporten skisserer. I tillegg må Norge legge mye mer penger på bordet for finansiering av både utslippskutt og tilpasning i andre land. Dette vil være den eneste rettferdige løsningen.

Anne-Marie Helland,
generalsekretær i Kirkens Nødhjelp,
august 2014

SAMMENDRAG

Rapporten "Norges rettferdige andel av en ambisiøs global klimainnsats" presenterer en utredning av hva som er Norges rettferdige andel av de globale utslippskutt som er nødvendige for å begrense global oppvarming til 2 °C over før-industrielt nivå.

Dette gjøres ved bruk av rammeverket "Greenhouse Development Rights" (GDR), som er utviklet av Stockholm Environment Institute og EcoEquity. Formålet med GDR er å finne en effektiv og rettferdig fordeling av den nødvendige globale klimainnsatsen, samtidig som behovet for utvikling for verdens fattige ivaretas. Det er derfor utviklet en metode for å beregne et lands rettferdige andel av den globale klimainnsatsen[1]. Dette gjøres ved å legge til grunn to grunnleggende prinsipper, som også fungerer som kriterier ved utregningene:

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, gjenstår det mye når det kommer til å finne ut hva de betyr i praksis. 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. GDR-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 to graders global oppvarming er lagt til grunn både fordi det er det man i de internasjonale forhandlinger har blitt enige om å begrense oppvarmingen til, og fordi det vitenskapelig regnes som en terskel vi ikke kan gå over hvis vi skal unngå de mest katastrofale og irreversible klimaendringene. Samtidig konkluderte FNs klimapanels femte delrapport, som ble presentert våren 2014, med at klimaendringene allerede har konsekvenser for dyreliv og økosystemer verden over, som igjen har store konsekvenser for mennesker.
For å øke sannsynligheten for å unngå katastrofale klimaendringer mest mulig, legger denne rapporten til grunn den utslippsbanen med størst sannsynlighet for å holde den globale oppvarmingen under 2 °C[2]. Dette innebærer at vi globalt fremover ikke kan slippe ut mer enn 785 gigatonn CO2. Det er mulig å oppnå de nødvendige kuttene som gir oss en god sjanse til å holde oss under 2 °C oppvarming, men det krever en umiddelbar og ambisiøs global innsats.

Gjennom GDR-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[3]. 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[4]. Begrunnelsen for det er at mennesker som lever i fattigdom har sluppet ut mindre klimagasser

1 Det er utviklet en online-kalkulator for å regne ut landenes rettferdige andel av den globale klimainnsatsen, basert på parametere som kan spesifiseres for ulike utregninger. Den er tilgjengelig på http://www.gdrights.org/calculator/

2 Denne utslippsbanen har høyere sannsynlighet for å begrense global oppvarming til 2 °C enn IPCCs "Strong pathway", som kun gis 66 % sannsynlighet for å nå 2 °C-målet. Online-kalkulatoren gir mulighet til å velge mindre ambisiøse utslippsbaner: http://www.gdrights.org/calculator/

3 Det er mulig å velge tidligere tidspunkt for å beregne historisk ansvar. Det kan argumenteres for at en såpass nylig dato er relativt generøs overfor industrialiserte land, som har hatt høye utslipp over langt tid i forkant av 1990. Ved å velge tidligere tidspunkt vil Norge og andre industrialiserte land får en høyere andel av den globale klimainnsatsen.

4 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.

som følge av lavere forbruk, og dermed har mindre ansvar, samt at de må bruke sin økonomiske kapasitet på utvikling og dermed ikke kan forventes å bidra like mye til den globale klimainnsatsen[5]. 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, samt en kombinert *Responsibility and Capacity Indicator (RCI)* 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, har Norge en RCI som langt overgår vår andel av verdens befolkning. Norges rettferdige andel av klimainnsatsen er altså større enn størrelsen på befolkningen skulle tilsi, nærmere bestemt mer enn ti ganger så stor. Norges befolkning utgjør kun 0,07 % av verdens befolkning, men vårt kombinerte ansvar og kapasitet (RCI) frem til 2020 utgjør 0,84 % av den totale globale innsatsen som er nødvendig[6]. Frem mot 2030 synker vår andel ned til 0,69 %, som en følge av at Norges økonomi ikke er ventet å vokse like raskt som mange andre land, samt at en del andre land vil øke sine utslipp som følge av høy økonomisk vekst. Likevel tilsier tallene en kraftig oppskalert nasjonal og internasjonal klimainnsats fra Norges side. I følge hovedscenarioet i rapporten må Norge innen 2020 kutte sine utslipp med nesten 300 % fra 1900-nivået, mens det innen 2030 må ned med 585 %, for å kutte i tråd med sin rettferdige andel.

Ettersom det ikke er mulig for Norge å kutte mer enn 100 % nasjonalt, og i praksis heller ikke er mulig å kutte alle klimagassutslipp i Norge, innebærer dette at Norge er nødt til å finansiere omfattende utslippskutt i andre land *i tillegg* til ambisiøse utslippskutt nasjonalt. Fordelingen av utslippskutt nasjonalt og internasjonalt er et komplisert spørsmål, som avhenger både av økonomiske og politiske vurderinger. I rapporten antyder vi 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, sammenliknet med våre forventede utslipp hvis vi ikke kutter noe. Det gjør at Norge innen 2020 må kutte 14 % nasjonalt sammenliknet med 1990-nivået, og 48 % innen 2030. *I tillegg* kommer en omfattende finansiering av utslippskutt i andre land. Hvor mye det kommer til å koste avhenger av prisen på utslippskuttene, som er høyst usikker. Ved å legge til grunn de høyeste prisanslagene fra FNs klimapanel innebærer Norges ansvar for klimakutt internasjonalt 55 milliarder kroner årlig innen 2020, med en oppskalering til 110 milliarder kroner årlig innen 2030. Lavere prisanslag innebærer kostnader på 18 milliarder kroner årlig innen 2020, og 30 mrd. innen 2030.

Dette er mye penger, og det vil kreve mye av Norge som samfunn å kutte nesten 50 % nasjonalt 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 er 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 kutte utslipp tilsvarende 100 % av norske utslipp (inkluderer både nasjonale og internasjonale kutt) innen 2030 gjennom Klimaforliket, forutsatt at det kommer på plass en bindende internasjonal avtale. 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.

5 Det er også satt en øvre grense på 50 000 dollar i året, hvor all overskytende økonomisk kapasitet inkluderes i beregningen av et lands økonomiske kapasitet. Ved en årsinntekt på 50 000 dollar tilhører man den rikeste 1 % av verdens befolkning, og kan dermed forventes å ha stor kapasitet til å bidra til å løse klimakrisen. Dette betyr ikke at all inntekt over denne grensen vil inngå i innsatsen for å løse klimakrisen, men at det skal tas med i beregningen av et lands kapasitet når fordelingen mellom land foretas.

6 Dette er tall fra det hovedscenarioet som rapporten presenterer. Alternative scenarioer basert på andre kriterier presenteres i rapportens vedlegg.

NORWAY'S FAIR SHARE OF AN AMBITIOUS GLOBAL CLIMATE EFFORT

ABSTRACT

This report presents results regarding Norway's fair share of the global response to the climate problem. This attention to fair shares is motivated by the simple fact that equity is important. Not only is a fair international agreement ethically desirable, it is also a necessity for addressing the climate problem. As highlighted in the Summary for Policy Makers of the IPCC's Fifth Assessment Report, "Outcomes seen as equitable can lead to more effective cooperation." Or, as often put even more succinctly, "Equity is the pathway to ambition."

This report is focused on mitigation, although an equitable approach to adaptation is of course equally important. It uses a flexible and transparent framework for equitable effort sharing that is drawn directly from the UNFCCC's core equity principles. The analysis is done using the *Climate Equity Reference Calculator*, an online tool and database that allows the user to select specific equity-related settings relating to Responsibility and Capacity and other key parameters, and then to use straightforward, standard quantitative indicators to calculate the implied national fair shares of the global mitigation effort. The analysis is based on a range of alternative input selections informed by ethical and empirical considerations that are discussed in more detail within the report.

Norway's situation as an exceptionally wealthy country whose prosperity has derived in considerable part from the extraction of fossil fuels puts it in a position of having considerable *Responsibility* for the climate problem as well as *Capacity* to help address it. As defined and calculated in the report below, Norway has nearly 1% of the global Responsibility and Capacity, even though it has less than 0.1% of the world's population. This suggests that Norway's fair share of the global mitigation effort would be more than 320 million tonnes CO2-eq in 2030, if the world is to be on a course that is likely to keep warming below 2°C.

It is infeasible for this entire effort to be undertaken wholly within Norway, as it would imply an emission reduction of nearly 600% below 1990 levels by 2030. However, Norway could fulfill this fair share through a combination of extremely ambitious mitigation efforts domestically of roughly 50%, along with international technological and financial support for mitigation efforts in other countries to achieve roughly 270 MtCO2eq worth of mitigation action.

INTRODUCTION

Norway has established itself as a global leader in the climate policy domain. Its concerted efforts to mobilize climate finance (Government of Norway, 2013; WRI/ODI/CICERO, 2013) have made it one of the largest contributors of climate-related support to developing countries[7]. Norway has surpassed its emissions reduction target of the first Kyoto commitment period, and has pledged[8] 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.

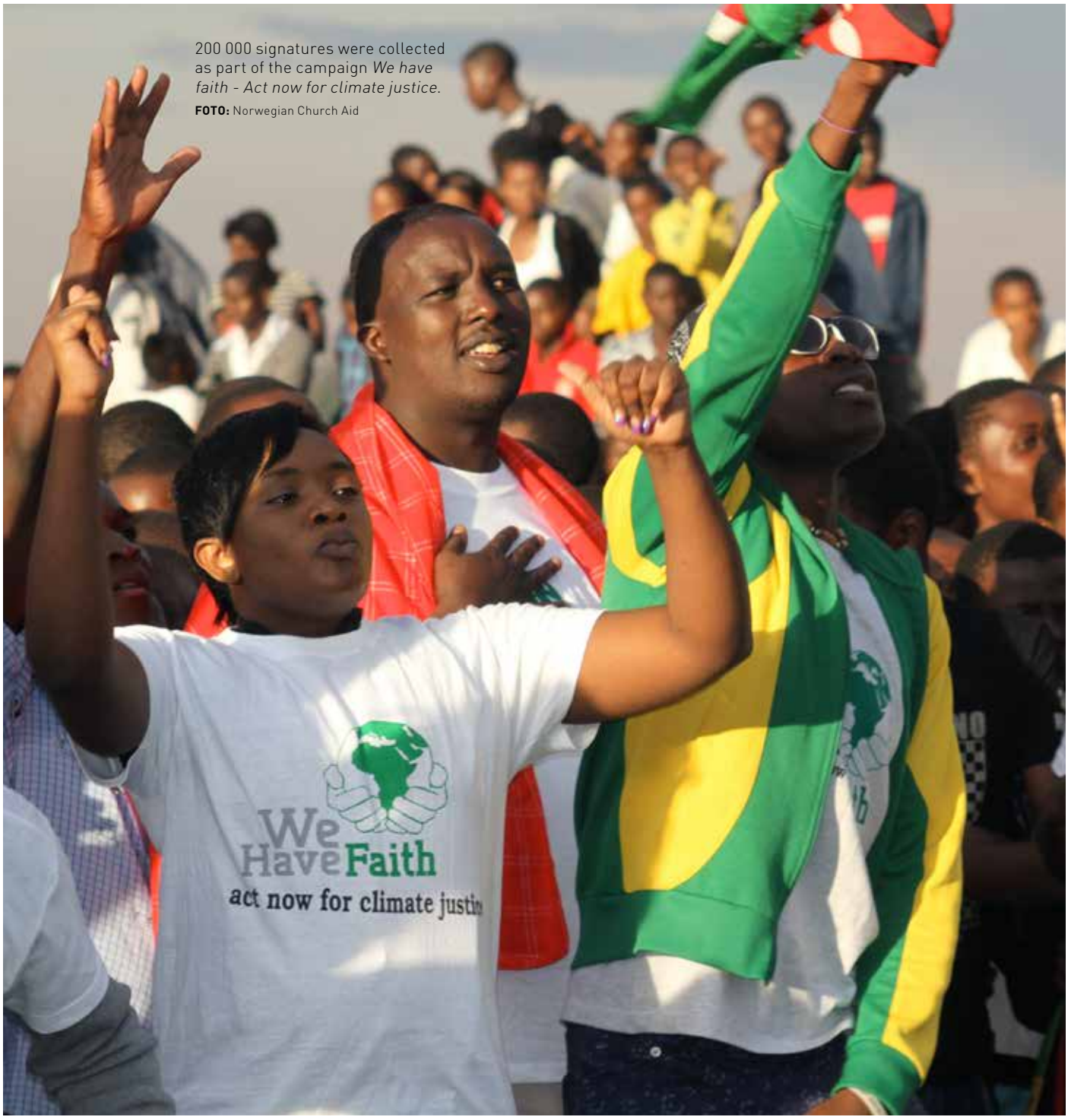
At the same time, it is important to assess Norway's ambitiousness not only in comparison with other countries, but in comparison with the requirements of science, and in light of Norway's position as an exceptionally wealthy country whose prosperity has derived in considerable part from the extraction of fossil fuels.

To help with such an assessment, this report considers Norway's fair share of the global climate effort. The analysis is done within the *Climate Equity Reference Calculator*[9], an online tool and database that allows the user to select specific equity-related settings relating to Responsibility and Capacity, and other key

7 Whether this is truly 'new and additional' (as, under the UNFCCC, developed country contributions are required to be) is subject to 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.

8 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."

9 http://www.gdrights.org/calculator/



200 000 signatures were collected as part of the campaign *We have faith - Act now for climate justice.*
FOTO: Norwegian Church Aid

parameters, and then to calculate the implied national fair shares of the global mitigation effort for all countries. This report presents a range of fair share results for Norway, based on a selection of alternative input settings made available in the *Calculator* and informed by ethical and empirical considerations as discussed further below. Norwegian Church Aid selected the six scenarios that are the focus of this report.

This attention to fair shares is motivated by the simple fact that equity is important. Not only is a fair international agreement ethically desirable, it is also a necessity for addressing the climate problem. As highlighted in the Summary for Policy Makers of the IPCC's Fifth Assessment Report, "Outcomes seen as equitable can lead to more effective cooperation." Or, as often put even more succinctly, "Equity is the pathway to ambition."

THE 2°C GOAL AND NEAR TERM MITIGATION AMBITION

In order to discuss fair shares of a global climate effort, it is necessary first to define explicitly the scale of the global effort. The *Climate Equity Reference Calculator* assesses fair shares with respect to the global goal of holding warming below 2°C. The *Calculator* does this by referencing two alternative global mitigation pathways that might be considered in light of the 2°C global goal – a "Strong 2°C pathway" and a "Weak 2°C pathway", as shown in Figure 1. The black line shows recent historical emissions, and the grey line a projection of global emissions if no emission reductions efforts were made (i.e., a "business-as-usual" emissions pathway). The colored lines show the alternative mitigation pathways.[10] For the purposes of this analysis, the most relevant features of these pathways are (1) their likelihoods of exceeding 2°C, and (2) the amount of mitigation they each require in the year 2030, as this is the overall global effort that we are here dividing into national fair shares.[11]

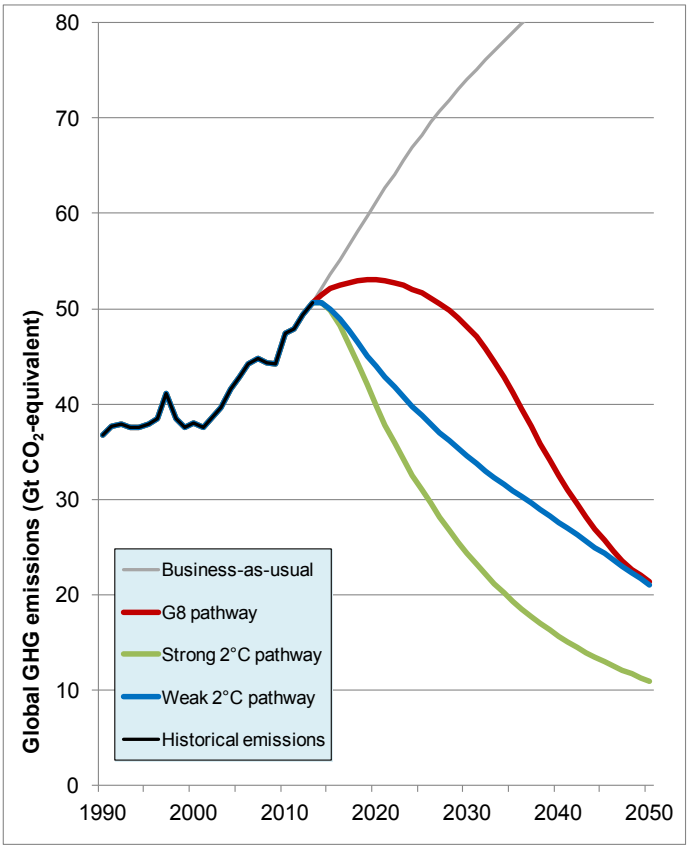


Figure 1: Three global mitigation pathways (and business-as-usual emissions

Each pathway's likelihood of exceeding 2°C can be informed by the recent IPCC Fifth Assessment Report (Working Group 1). In its report, the IPCC provided carbon dioxide budgets that are consistent with various probabilities of exceeding 2°C. The Fifth Assessment Report provided budgets consistent with maintaining various levels of likelihood of keeping warming below 2°C. Specifically, it provided carbon dioxide budgets consistent with a 66%, 50%, and 33% chance of keeping warming below 2°C, by comparing the remaining budgets (shown in the rows labeled "2012 forward") of the Strong 2°C and Weak 2°C pathways to each of these IPCC budgets, we can see whether they imply higher or lower levels of ambition, and thus higher or lower likelihood of keeping warming below 2°C. The key figures of these two pathways are shown in Table 1, along with the three IPCC budgets.

Key data for the two pathways (and three IPCC carbon budgets against which the pathways are compared)

	Strong 2°C pathway	Weak 2°C pathway	
2020 emissions (GtCO2eq)	40	44	
2030 emissions (GtCO2eq)	25	35	
Required emission reduction in 2030 (relative to business-as-usual, GtCO2eq)	50	40	
Budget (2012 forward) (GtCO2)	785	1310	
IPCC carbon budgets (for specified probability of keeping warming below 2°C)	>66%	>50%	>33%
Budget (2012 forward) (GtCO2)	1010	1120	1410

Table 1. Key data for the two mitigation pathways, and the IPCC carbon dioxide budgets against which to compare them.

10 For comparison, Figures 1 and 2 (and also the Calculator) also includes a much weaker "G8 pathway" – consistent with the global targets specified in the official declaration of the Group of Eight industrialized countries at its 2009 Summit in L'Aquila, Italy (G8 2009). As seen from Figure 2 below, the G8 Pathway provides less than a 33% chance of keeping warming below 2°C. See Baer et al. (2013) for further details about these pathways and their assessment as it will not be used on this report.

11 This same approach could be adopted to determine fair shares of costs related to adaptation and to loss and damage. Once there are comprehensive and reliable estimates of these costs, quantitative estimates could be made of national fair shares.

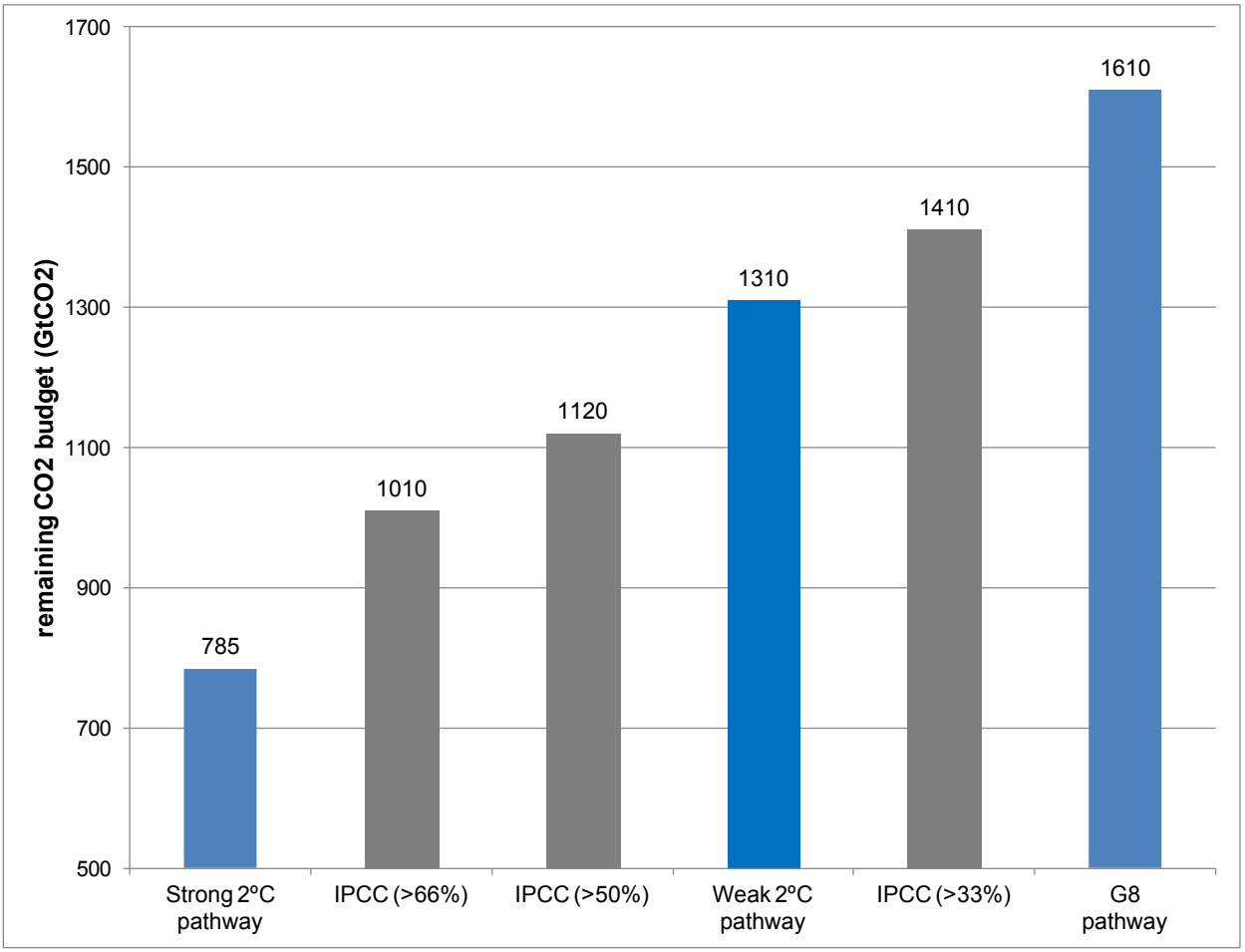


Figure 2: The remaining CO2 budgets associated with the alternative mitigation pathways, as well as the IPCC's three carbon budgets.

Figure 2 above compares the CO_2 budgets of the two pathways[12] to the budgets associated with a 67%, 50%, and 33% chance of keeping warming below 2°C, as presented by the IPCC.[13]

This comparison allows us to conclude the following:

- The Strong 2°C pathway, with an emission budget well below the IPCC 67% budget, has greater than 67% chance of keeping warming below 2°C
- The Weak 2°C pathway would have a 33% to 50% probability of keeping warming below 2°C, that is it is *more unlikely than likely* to keep warming below 2°C.

Because the Strong 2°C path provides considerably greater security of keeping warming below 2°C than the Weak 2°C path, Norwegian Church Aid has identified it as the preferred pathway for assessing fair shares. The motivation to ensure warming stays below 2°C has only been reinforced by the findings of the recent released IPCC Fifth Assessment Report, the second volume of which focuses on climate impacts, adaptation, and vulnerability. It highlighted the impacts that are already being felt on water resources, agricultural systems, species habitats, and other human and natural systems. Not only will further warming intensify these impacts, but will also raise the risks of extreme weather events and potentially abrupt and irreversible large scale changes due to tipping points in the climate system. The IPCC's report also cautioned that there are limits to adaptation, and that mitigation increases the time available for adaptation, possibly by several decades. Accordingly, the results presented in the Results section below are based on the Strong 2°C pathway, with the Weak 2°C pathway results given in the Annex in alternative, less-preferred scenarios.

12 The chart also shows the pathway corresponding to the G8 Declaration, with a budget well above the IPCC's 33% budget, has a considerably less than 33% chance of keeping warming below 2°C.

13 The IPCC provides less explicit information on the likelihood of exceeding 1.5°C, but based on the information given, it is possible to conclude that the Strong 2°C path's chance of keeping warming below 1.5°C is "more unlikely than likely" (less than 50%) and the Weak 2°C path is "unlikely" (less than 33%). See table SPM1 in the *Climate Change 2014: Mitigation of Climate Change – Summary for Policymakers, Contribution of Working Group III to the Intergovernmental Panel on Climate Change Fifth Assessment Report*, Berlin, Germany. http://www.mitigation2014.org.

SHARING THE EFFORT BASED ON RESPONSIBILITY AND CAPACITY

This report uses an approach to fair shares that draws directly from the core equity principles of the United Nation Framework Convention on Climate Change. As noted in the Principles (under 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, in which Principle 7 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).

The two principles of Responsibility and Capacity are virtually universal principles, quite consistent with those ethical standards that societies tend to apply within their own sovereign countries. Common sense ethics (and legal practice) hold persons responsible for harms or risks they knowingly impose or could have reasonably foreseen, (and, in certain cases, regardless of whether they could have been foreseen). The principle of Responsibility is thus closely connected to the Polluter Pays principle, and effort-sharing principles which derive from it hold that countries should be accountable for their greenhouse gas emissions. Generally, the principle of Capacity is taken to imply that the more one can afford to contribute to the costs of preserving or generating societal public goods, the more one should. A minimal interpretation of this is that one's efforts should be in proportion to one's resources, however most ethical perspective take a stronger stance, calling for a progressive approach. This is why most societies have progressive income taxation, where by marginal tax rates rise with income.

Reflecting these underlying ethical principles, the equity approach adopted in this report assigns fair shares of the global climate effort to countries in proportion to their Responsibility and Capacity. The approach starts with identifying a global mitigation pathway of a specified level of ambition – which implies a certain amount of required global mitigation effort in each year. Each country's fair share of the global mitigation effort in each year is then determined by its share of global Responsibility and Capacity, expressed in terms of straightforward, standard quantitative indicators. Figure 3 provides a visual representation of this approach. The left panel shows the global mitigation effort as the large blue wedge

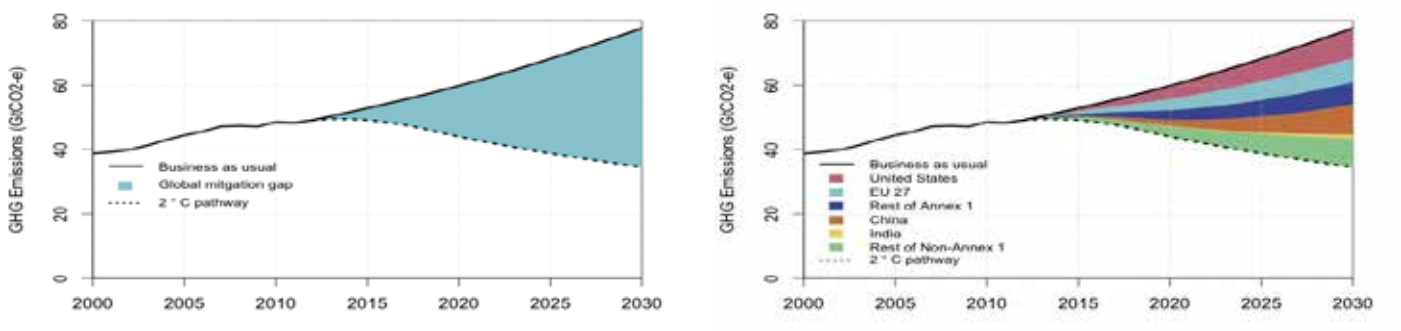


Figure 3: The totally globally required mitigation (blue area) divided among countries in proportion to their share of global Responsibility and Capacity.

growing over time, spanning the space between the business-as-usual pathway and a 2°C pathway. The right panel shows this global mitigation divided up among countries (only a subset of major ones are shown, with all the rest are grouped for visual clarity) in proportion to their Responsibility and Capacity. If this approach to effort-sharing were adopted, each country would be obliged to bear the cost of the mitigation represented by its corresponding wedge.

CAPACITY:

As has become customary in discussions of equitable effort-sharing, Capacity is represented in financial terms. This is not necessarily because financial income is the only important type of capacity for dealing with climate change, but it is extremely highly correlated with the other various types of capacity that are also important (technological capacity, institutional capacity, etc.). Just as income is typically considered in a progressive manner in national tax policy, it can analogously be defined in a progressive manner for the purposes of defining Capacity. A straightforward method for doing this is to define an income level below which income does not count toward capacity, similar to a "0% tax bracket" that exists in most national tax schedules. Extending the comparison to a tax schedule, a higher income level can also be set at which income counts fully 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.

The distinction between a system with no progressivity, relatively low progressivity, and higher progressivity is shown in Figure 4. In the "No progressivity" case, every dollar of income earned by every person in the country, regardless of their total income, would count 100% toward the calculation of a country's capacity (red line). In the "Low progressivity" case, income earned below a lower threshold does not count toward national capacity, and income above counts 100% (blue line). In the "High progressivity" case, income below the lower threshold does not count, income above a higher threshold counts 100%, and between the two thresholds income counts to an extent that gradually rises from 0% to 100% (green line). It is the higher progressivity approach that is taken in this report.

The *Climate Equity Reference Calculator* allows the user to set the lower and upper thresholds at any specified income levels. (The *Calculator* refers to the lower income level as the "development threshold" and the higher income level as the "luxury threshold", terms chosen to be suggestive a particularly compelling interpretation of these thresholds.) Since the lower threshold marks the income level below which a person does not incur any climate obligation, it makes sense to set it to reflect a level of welfare below which people are understood to have *development* as their proper priority, and are not expected to have to share the costs of the climate transition. That is, these people should not be required to make sacrifices in order to lessen the

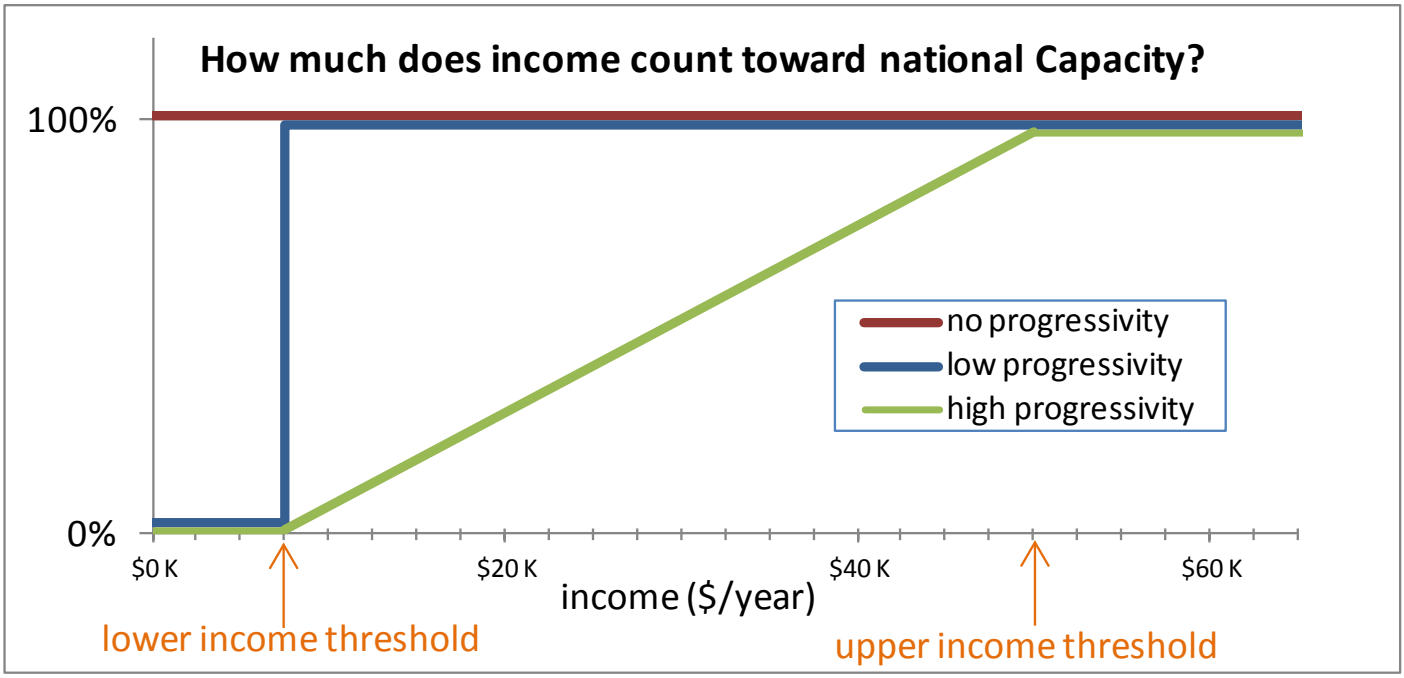


Figure 4: This graph illustrates a "no progressivity" case, a "low progressivity" case, and a "high progressivity" case. The x-axis is income, the y-axis is the rate at which income counts toward capacity.

burden on wealthier people, because of their pressing need to prioritize their own development. Hence the use of the term "development threshold". People above the threshold are taken as having realized their right to development and as bearing the responsibility to preserve that right for others. They must, as their incomes rise, gradually assume a greater faction of the costs of curbing the emissions associated with their own consumption, as well as the costs of ensuring that, as those people below the threshold rise towards and then above it, they are able to do so along sustainable, low-emission paths.

In the results presented here, the development threshold is set modestly higher than a global poverty line, which is itself about US$16 per day per person (PPP adjusted[14], 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 per cent 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 consistent with a typical poverty line in a developed country.

14 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.

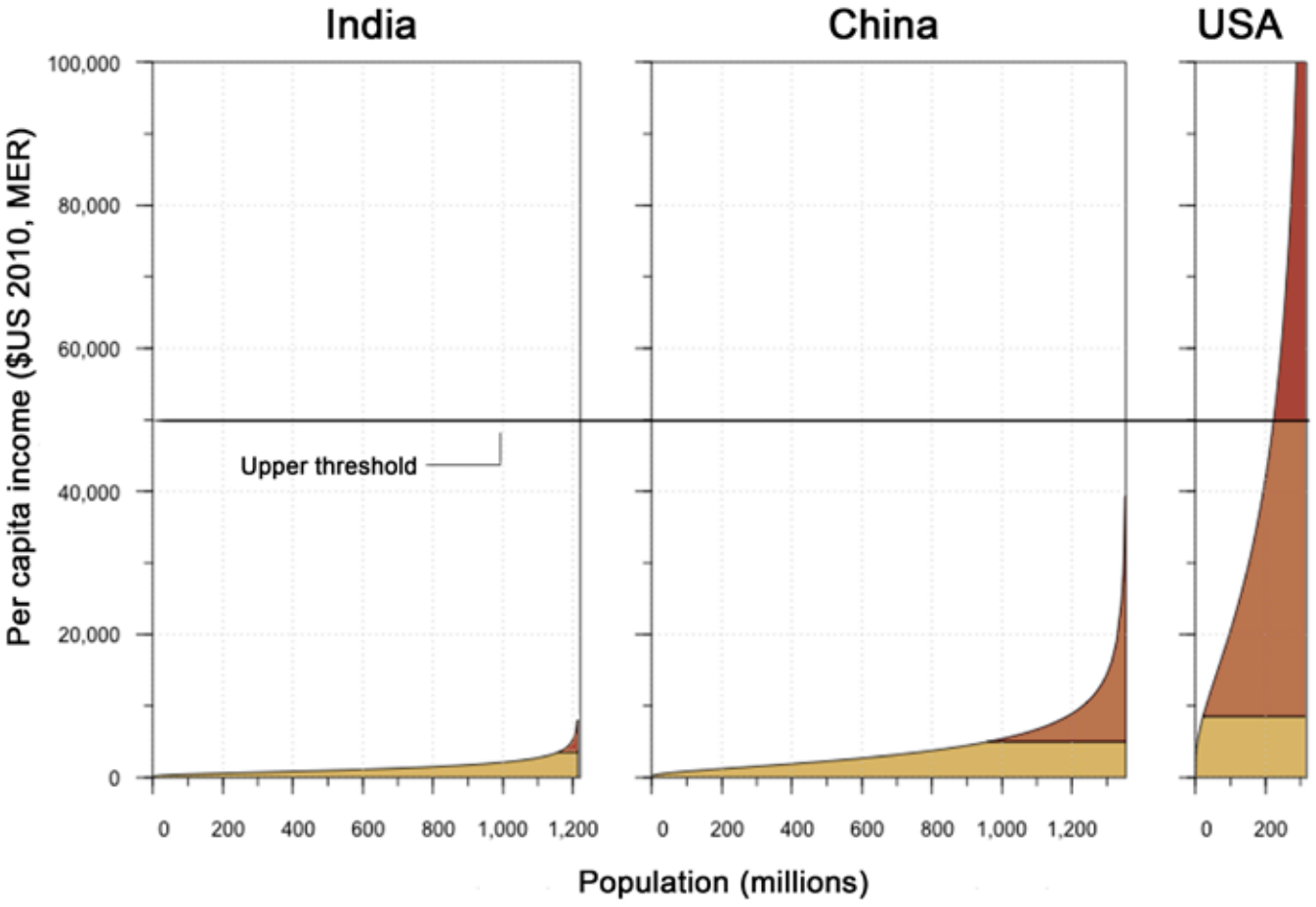


Figure 5: Capacity in 2010, for three countries. The curves show income distributions. Income below (tan) a lower threshold (set at $US 7,500) does not count toward a nation's Capacity, income above (red) the upper threshold (set at $50,000) counts fully, and income between the thresholds counts partially, at a rate that rises steadily from 0% to 100%.

Since the upper threshold marks the income level above which income counts fully toward the calculation of a country's Capacity, it makes sense to set it at a level that generally reflects a lifestyle at which further income would be spent not on basic necessities. In this report, this upper threshold is set at US(MER)$50,000, an income that is in the general range defining the global 1% income class.

Figure 5 below shows how the development threshold and upper threshold relate to income in three countries: India, China, and the US. The figures shows reasonable approximations[15] of the income distributions for each countries. Each chart arrays people from poorest (on the left) to the wealthiest (on the right) member of each countries, and plots their income. The x-axis is scaled to population, so the areas can be compared visually to infer relative capacity. A development threshold of $7,500 is converted for the national economic context of each country using Purchase Power Parity (PPP) exchange rates. Each country's income distribution curve is divided by this development threshold, thus dividing total national income into a fraction (tan) below the development threshold, and a fraction (red) that the wealthier portion of the population earns in excess of the development threshold. The tan portion reflects the income that does not count toward the calculation of the country's capacity. The red portion reflects the income that does count. An upper threshold is also shown, indicating the point above which income counts fully toward capacity. (Between the development threshold and the upper threshold, the extent to which counts toward capacity rises linearly from 0% to 100%.)

As it turns out, nearly 7% of India's population earns more than $7,500 according to these estimates. These are the members of the Indian "middle class". In terms of sheer numbers, they comprise a large and growing consuming class, one that is roughly the size of the population of the consuming class in, say, the United Kingdom or France. But this is there where the similarity ends. For these Indian consumers still have a much lower incomes (and consumption levels, and environmental footprints) than their British and French counterparts, and the part of India's income that lies above the $7,500 development threshold is less than one-tenth as large as the UK's or France's. Similar observations can be made about the approximately one-quarter of China's population that comprises its consuming class, which fully as large as the US population, nearly all of which is above the development threshold. However, China's income above the development threshold is less than one-third as much as the US's. As is clear from these charts, the US, despite its much smaller population, has a much greater share of the capacity.

Using a country's income distribution to assess a country's Capacity provides information about how a country's income is shared among its people: how much of a country's resources is going toward meeting basic needs of its poor, or providing modest comforts of its middle class, or supporting the luxury consumption of its elite. The more unequal the income distribution, the more income a country is choosing to devote to high-level consumption at the expense of more fundamental needs. This is reflected in the approach used here to calculate Capacity: between two countries with the same average level of income, the one with a more inequitable income distribution is devoting more of its income to discretionary expenditures, and can thus be expected to also contribute more to the global climate response. Its calculated Capacity will thus be higher, and thus a larger fair share of the effort. This approach rewards countries for equitable rather than inequitable growth, and provides an incentive for ensuring that future growth is distributed more equitably.

RESPONSIBILITY:

Responsibility is represented by cumulative GHG emissions, which directly reflects a nation's contribution to climate change. For this analysis, the initial date for accounting for cumulative emissions is 1990, arguably a very late date that is generous to industrialized countries, reflecting a time frame during which countries were already in the process of negotiating an international climate agreement. Other dates could be justified, (and can be selected in the online *Calculator),* 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

15 The Climate Equity Reference Calculator includes this income distribution information for all Parties to the UNFCCC, using data from the World Bank and the World Income Inequality Databases of per-capita incomes and GINI coefficients, respectively, and the approximation of lognormal income distributions.

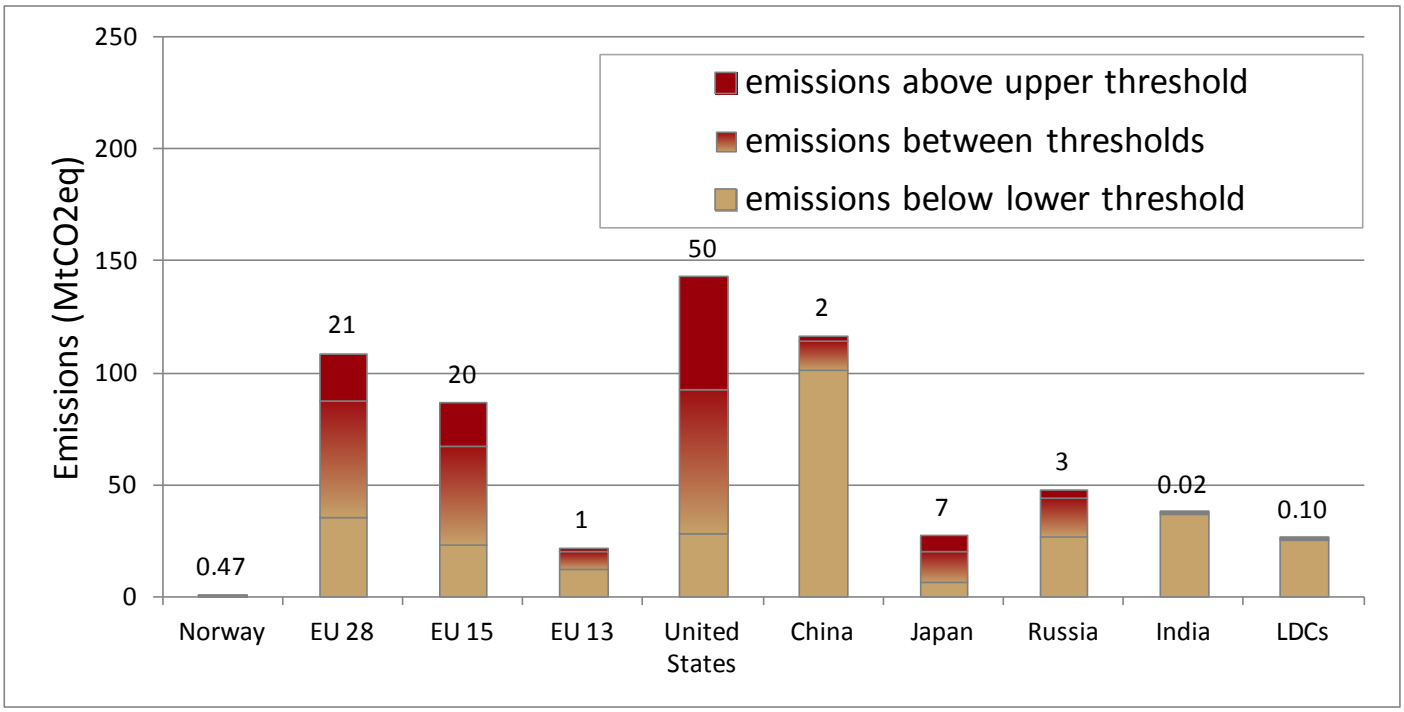


Figure 6: Responsibility in 2010, for several countries (or groups). The bars show cumulative emissions since 1990, showing emission corresponding to consumption below (tan) a lower threshold (US$7,500) and above (red) an upper threshold ($US 50,000). (The coloring between the thresholds shifts gradually from tan to red.)

carbon emissions of industrializing countries became significant.

Similar to the definition of Capacity, Responsibility is defined in a manner that excludes emissions corresponding to consumption below a lower threshold, and fully counts emissions corresponding to consumption above an upper threshold. Figure 6shows cumulative emissions since 1990 for several countries and groups, dividing those emissions into those corresponding to consumption below the threshold (set at US$7,500) and above the threshold. Setting the threshold at the same "development threshold" as in the case of capacity reflects a level of consumption below which the priority concern is basic development needs. This reflects the perspective that – absent financial and technological support to meet needs through alternative lower-GHG means – "survival emissions" do not imply moral responsibility in the manner that emissions at higher levels of welfare and consumption do.

Using these definitions, Responsibility and Capacity can be calculated for each country over time, and used to create a combined Responsibility and Capacity indicator (RCI). The simplest way to create an RCI is to weight Responsibility and Capacity equally (simply averaging them together), reflecting the perspective that the two should count equally toward determining a country's fair share. This is the weighting used in this report. Alternatively, one could weight the two unequally, giving greater priority to either Capacity or Responsibility.

For several representative countries (or groups), the table below shows the share of global Capacity and Responsibility in 2010, and well as the combined Responsibility and Capacity Index in 2010. The RCI in 2020 and 2030 is shown as well. As the countries' economies and emissions are projected to grow at different rates over time, their share of global Capacity and Responsibility correspondingly varies. For each country, this RCI can then be used to determine its fair share of the globally required mitigation effort, as illustrated in Figure 3. This fair share will be met through domestic mitigation actions and, if necessary to fulfill the country's fair share, by also providing financial and technological support to other countries to undertake mitigation.

	2010					2020	2030
	Population (% of global)	**GDP per capita** ($US PPP)	**Responsibility** (% of global)	**Capacity** (% of global)	**RCI** (% of global)	**RCI** (% of global)	**RCI** (% of global)
Norway	0.07%	$46,887	0.44%	1.39%	0.92%	0.84%	0.69%
EU 28	7%	$27,644	20%	26%	23%	20%	18.2%
EU 15	6%	$30,688	19%	25%	22%	19%	17.0%
EU 13	1.6%	$16,411	1.1%	0.9%	1.0%	1.1%	1.2%
United States	5%	$41,773	47%	39%	43%	40%	36%
China	20%	$6,713	2%	4%	3%	8%	14%
Japan	1.8%	$30,729	7%	11%	9%	8%	7%
Russia	2.1%	$13,998	3%	1%	2.2%	2.5%	2.8%
India	17%	$3,171	0.02%	0.02%	0.02%	0.06%	0.15%
LDCs	11%	$1,498	0.09%	0.03%	0.06%	0.08%	0.09%
Annex 1	19%	$28,596	85%	86%	86%	79%	72%
Non-Annex 1	81%	$5,445	15%	14%	14%	21%	28%
World	100%	$9,777	100%	100%	100%	100%	100%

Table 2: For a representative set of countries (and groupings):, population, income, Capacity, Responsibility, (for 2010), and combined Responsibility and Capacity Indicator – RCI (for 2010, 2020, and 2030).

For Norway, the RCI yields a fair share of the mitigation effort that would require both mitigation effort and financial support. Indeed, generally for wealthy and high emitting countries (i.e., those with higher capacity and responsibility) such as Norway, the fair share generally greatly exceeds the country's domestic mitigation potential (and perhaps even its domestic emissions). This is especially true for countries whose Capacity is greater than their Responsibility. For poor and low emitting countries (i.e., those with lower capacity and responsibility) – the domestic potential for curbing emissions may greatly exceed the country's fair share of the global mitigation effort. For countries in the middle, the two may be more closely matched.

This is the fundamental reason that fair shares must be seen not only in terms of domestic reductions obligations, but also in terms of required support for mitigation in other countries. Otherwise, the wealthier countries would be saddled with greater mitigation obligation than they can possibly discharge, and poorer countries would be left with great deal of unexploited mitigation options. This situation simply isn't tenable if a stringent global mitigation pathway is to be pursued. Consequently, this report explicitly presents fair shares in terms of the sum of reductions achieved domestically and reductions achieved through the transfer of international support.

RESULTS

For this analysis, a set of different alternative assumptions were explored, comprising six scenarios. The main scenario (Scenario 1) is presented here, and the other five in the Annex. The main scenario adopts the Strong 2°C pathway as the global level of ambition, and defines each county's RCI as the average of its Responsibility and its Capacity, giving each a 50% weighting.

Several other assumptions (all of which can be varied in the online *Calculator*) are held constant across these scenarios. These include the following:

- Lower threshold: US(PPP)$7500 per capita per year, as discussed above
- Upper threshold: US(MER)$50,000 per capita per year, as discussed above
- Responsibility Cumulative emission initial year: 1990 , as discussed above
- Emissions accounting: Production-based (not consumption-based) accounting
- Choice of GHGs: Non-CO2 emissions included in assessment of Responsibility, but not land use emissions.

Table 3 shows the results for the main scenario considered in this report for 2020 and 2030. It provides, in both years, Norway's RCI and its fair share of the mitigation effort (calculated by multiplying Norway's RCI by the total mitigation required globally in 2020 and 2030), which are 21 and 50 GtCO2eq respectively in the Strong 2°C pathway. It expresses this fair share both in tonnes, and as a percent reduction below Norway's 1990 emission levels. Table 3 also provides Norway's fair share divided into a domestic portion and an international portion, using a simple indicative methodology as described below.

NORWAY'S FAIR SHARE		
Settings		
Pathway	Strong	
Responsibility weighting	R=50%	
Capacity	C=50%	
	2020	**2030**
Results		
Norway's RCI	0.84%	0.69%
Norway's fair share of the global mitigation effort (MtCO2e)	165	323
Expressed as a (%) reduction below 1990	297%	585%
Domestic portion (MtCO2e)	23	53
(as % relative to 1990)	-14%	-48%
International portion (MtCO2e)	142	271
in Billion US$/year		
assuming $20/tonCO2e	$3	$5
assuming $65/tonCO2e	$9	$18

Table 3: Results for main scenario examined in this report for 2020 and 2030. (See Annex for alternate scenarios.)

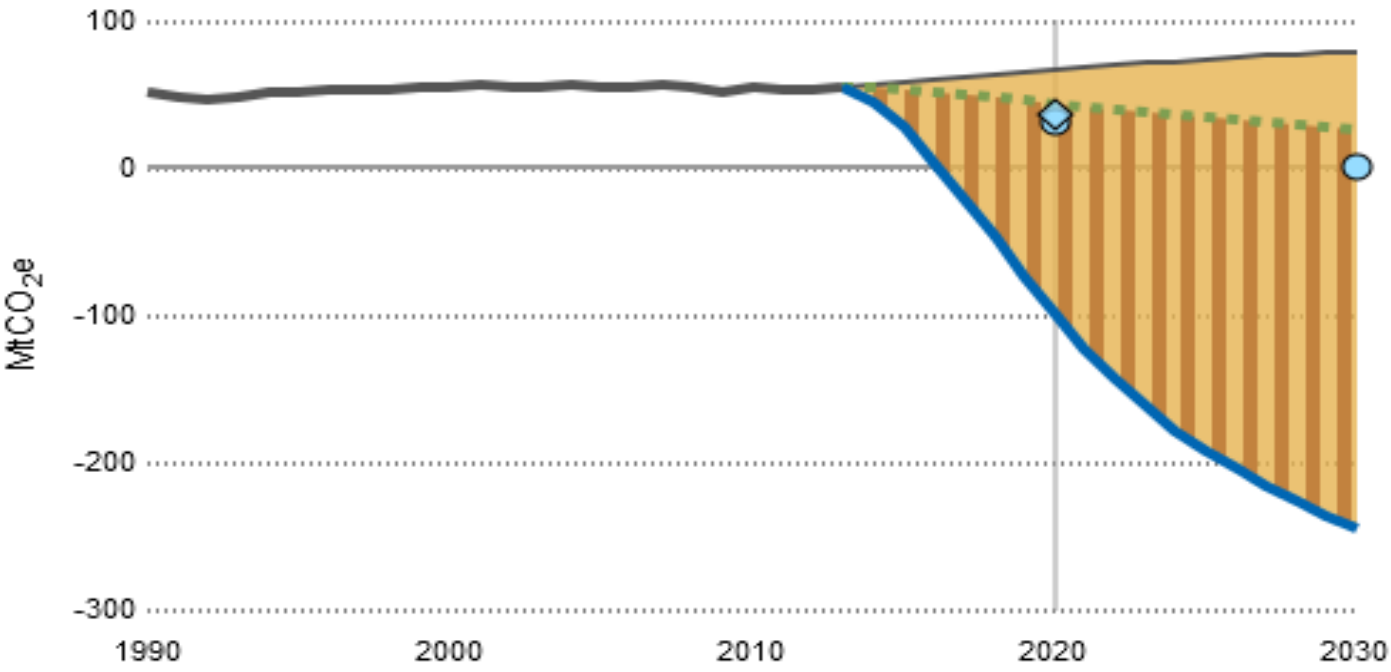


Figure 7: Emissions allocation for Norway, showing fair share of the total global mitigation effort divided into a portion to be undertaken through domestic reductions and a portion to be undertaken by providing support for reductions carried out in other countries.

Figure 7 illustrates the results reflecting Norway's fair share of the global mitigation effort, based on the specified settings. The blue line shows Norway's allowable emissions, if all of its fair share of the mitigation were undertaken domestically. Clearly, with Norway's emissions allowance being zero within a few years, and increasingly negative for the succeeding years, Norway could not feasibly undertake all of its fair share of the mitigation effort domestically.

For this reason, Figure 6 also shows the total fair share of the mitigation effort divided into a domestic portion (solid) and an international portion (shown with stripes). The international portion would be achieved by providing sufficient financial and technological support to compensate other countries for undertaking an equivalent amount of mitigation.

This division into domestic and international mitigation is approximate and merely indicative. A more precise estimate would require an analysis to calculate a cost-effective distribution of mitigation among all countries based on detailed, bottom-up, techno-economic data regarding each country's domestic emissions potential. As no such definitive analysis exists for all countries, we provide an illustrative estimate that simply assumes that national emissions in all countries drop at the same rate below national business-as-usual (BAU) as the global target drops below global BAU. Thus, emissions in all countries drop by the same percent below BAU. In 2030, this implies that all countries' domestic mitigation brings their emissions to approximately 70% below BAU for the Strong 2°C pathway, 60% for the Weak 2°C pathway.

Table 4 translates the support for international mitigation into financial terms. To do this, it is necessary to know the cost of mitigation. However, mitigation costs are still extremely uncertain, especially future costs, and there are thus no definitive cost figures. Indeed, as the IPCC noted prominently in its Working Group 3 Summary for Policy Makers, "Estimates of the aggregate economic costs of mitigation vary widely and are highly sensitive to model design and assumptions as well as the specification of scenarios, including the characterization of technologies and the timing of mitigation." Nonetheless, the IPCC did provide (quite broad) ranges of costs for several levels of mitigation ambition (See Working Group 3 SPM Table 2), which we have adopted as a basis for this analysis.

We use these IPCC cost figures[16] in this report, noting that each of the mitigation pathways (Strong 2°C and Weak 2°C) can be associated with one of the broad ambition levels with respect to which the IPCC presents its cost results. These two ambition levels, each corresponding to a greenhouse gas emissions budget range, are shown in the table below.

	Strong 2°C pathway	Weak 2°C pathway
IPCC category	"450 ppm"	"500 ppm"
Average cost of mitigation in 2030 $ per ton CO2e (% consumption losses)		
Low estimate	$20 (1.0%)	$15 (0.6%)
High Estimate	$65 (3.7%)	$50 (2.1%)

Table 4: Low and high estimates of unit costs of mitigation based on IPCC results.

Since the IPCC's cost figures span quite a wide range for each of the three mitigation levels, with the high estimate being three or more times the low estimate, the calculated costs per ton span a similarly wide range. Also, in addition to the IPCC caveats noted above, it is important to highlight that the cost per ton calculated here provides no disaggregation by sector or country, and accounts only for those costs and benefits that are considered by the models in the IPCC's database of cost studies. In light of these caveats, we stress that these cost figures are only rough estimates, and should be taken to serve as a helpful but by no means definitive guide to the costs associated with the fair shares that are calculated in this analysis.

16 The figures in parenthesis in Table 4, taken from Table SPM2 (AR5, Working Group 3 report), are annual costs of mitigation in 2030 expressed by the IPCC as "losses in global consumption—not including benefits of reduced climate change as well as co-benefits and adverse side-effects of mitigation". Generally, the economic models assessed by the IPCC consider direct costs such as the incremental costs of lower-GHG investments, fuel cost savings from improved efficiency, costs of accelerated capital retirement, and so on. (Some models also consider indirect costs such as feedbacks of energy price changes on the broader economy.) These costs might be borne publicly or privately, depending on the national context, institutions for international cooperation, and policy choices.

Total mitigation costs come to roughly $0.9 – 3.3 trillion for the Strong 2°C pathway, $0.5 – 1.9 trillion for the Weak 2°C pathway, and $0.2 to 1.2 trillion for the G8 pathway. We use these consumption loss figures as reported to provide rough estimates of average (not marginal) cost per ton of mitigation. For each pathway, the cost (expressed by the IPCC as a percent of consumption) is translated into $US by assuming that global GDP expands to $120 trillion in 2030 and final consumption continues to comprise approximately 75% of GDP. This figure is then divided by the total amount of mitigation required for the corresponding pathway in 2030, to yield the average cost per ton shown in Table 4. Note, we have used these figures as cost estimates for 2020, as the IPCC did not provide 2020 estimates.

CONCLUSIONS

The analysis presented provides a rigorous assessment of Norway's fair share of an ambitious global climate mitigation response. Using on an equitable effort sharing framework that draws directly from the UNFCCC's core equity principles, it is based on a range of input selections that were specified by Norwegian Church Aid based on ethical and empirical considerations that are detailed in the report.

The key observation is that Norway, as a wealthy developed country that has become prosperous in part through the exploitation of its generous fossil fuel endowment, has a correspondingly large Responsibility and Capacity in the context of climate problem and its solution.

Despite Norway's small size – less than 0.1% of the global population – it currently has about 0.4% of the global Responsibility for climate change, and about 1.4% of the global Capacity, as these indicators are defined for this analysis. While these shares are expected to decline somewhat over time as Norway's projected economic growth is slower than that of many other rising economies (see Table 3), they will remain at levels that maintain Norway as a small but nonetheless important country in modeling a fair approach to effort-sharing.

A key initial observation is that it remains feasible to keep warming from exceeding 2°C, but that prompt and ambitious mitigation would be needed worldwide. The mitigation pathway that is the focus of the current analysis would maintain a likely change that warming stays below 2°C, but would require the global greenhouse gas emission level in 2030 to be one-third what it would otherwise be in along a business-as-usual growth path. With global mitigation amounting to roughly 67% by 2030 relative to BAU, (or, equivalently, 50% relative to today's' emissions), no economy can be excused from urgent and ambitious mitigation. This rate of mitigation would imply a roughly 50% domestic emission reduction for Norway in 2030 relative to 1990 levels, although still greater levels of domestic reductions could be justified.

The most notable finding from this analysis is that Norway's fair share of the global mitigation effort is large enough to make its international efforts no less important than its domestic efforts. Indeed, in the main scenario examined here, the mitigation action that Norway may be expected to enable through financial and technological support (~270 MtCO2eq in 2030) is nearly five times what it might be expected to undertake domestically (~50 MTCO2eq in 2030). (This result is robust across the six scenarios presented here, with the mitigation supported internationally amounting to between two and nearly ten times the mitigation undertaken domestically.) Based on the estimates of the average incremental cost of mitigation in 2030 drawn from the IPCC's Fifth Assessment Report, this international support for mitigation correspond to roughly US$ 5 to 18 billion per year in 2030.

As noted, both Norway's Responsibility and its Capacity are disproportionate for a country of its size. Whereas for most countries the two indicators are similar, Norway's Capacity is considerably greater than its Responsibility. As is shown in the Annex, an approach to equitable effort sharing that prioritizes Capacity more than Responsibility (i.e., Scenarios 2 and 4) would oblige Norway to contribute more. However, even approaches that prioritize Responsibility (i.e., Scenarios 3 and 6) would require Norway to couple its ambitious domestic mitigation efforts with a large amount of international support.

As can be expected, in those scenarios in which global efforts seek to ensure a likely chance that warming will stay below 2°C, (i.e., scenarios 1, 2, and 3 based

Lack of water can lead to conflict in communities. In the future climate change will make the weather even more unpredictable.
PHOTO: Greg Rødland Buick

on the Strong 2°C mitigation pathway), Norway's fair share is correspondingly larger than those scenarios that forego this objective (i.e., scenarios 4, 5, and 6, based on the Weak 2°C mitigation pathway). In the more ambitious scenarios, Norway's fair share of the global effort (including both domestic and international efforts) would amount to between approximately 250% and 1000% reduction below its 1990 levels, whereas in the less ambitious scenarios, Norway's share amounts to between roughly 200% and 800%. This reduction in effort, which translates to less action on both the domestic and international fronts, comes at the cost of a pathway that has a considerably greater than 50% chance that warming will exceed 2°C, and the correspondingly greater expected costs of climate impacts.

ANNEX

This Annex gives results of scenarios based on varying the main scenario in two ways to examine alternative scenarios. First, it also considers the less ambitious Weak 2°C pathway. For all countries, this alternative naturally implies fair shares of the global effort that equate to proportionately less (about 15% less) mitigation.

Second, this analysis considers alternatives to an equal weighting of Responsibility and Capacity in defining the RCI, including both full weighting of Capacity, and full weighting of Responsibility. For many countries, these alternatives will not significantly change results, as Capacity tends to be highly correlated Responsibility. Norway, however, is a bit unusual, in that its Capacity exceeds its Responsibility significantly.

	R=0% (C=100%)	R=50% (C=50%)	R=100% (C=0%)
Strong 2C Pathway	*Scenario 2*	*Main scenario (Scenario 1)*	*Scenario 3*
Weak 2C Pathway	*Scenario 4*	*Scenario 5*	*Scenario 6*

Table A1: Six scenarios examined in this report. The alternatives differ from the Main Scenario in either the level of ambition (Strong 2°C or Weak2°C), and/or the relative weighting of Responsibility and Capacity (0%/100%, 50%/50%, or 100%/0%)

Results for 2030	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Settings						
Pathway	Strong 2C	Strong 2C	Strong 2C	Weak 2C	Weak 2C	Weak 2C
Responsibility weighting	R=50%	R=0%	R=100%	R=0%	R=50%	R=100%
Capacity	C=50%	C=100%	C=0%	C=100%	C=50%	C=0%
Results						
Norway's RCI	0.69%	1.17%	0.34%	1.17%	0.70%	0.35%
Norway's fair share of the global mitigation effort (MtCO2e)	323	546	157	440	265	131
Expressed as a (%) reduction below 1990	585%	1028%	255%	818%	470%	204%
Domestic portion (MtCO2e)	53	53	53	42	42	42
(as % relative to 1990)	-48%	-48%	-48%	-28%	-28%	-28%
International portion (MtCO2e)	271	494	104	398	223	89
in Billion US$/year in2030						
assuming $20/tonCO2e	$5	$10	$2	$8	$4	$2
assuming $65/tonCO2e	$18	$32	$7	$26	$14	$6

Table A2: Results for 2030 for the six scenarios examined in this report and described in Table A1.

REFERENCES

Baer, Paul, Tom Athanasiou, and Sivan Kartha (2013). Three salient global mitigation pathways, assessed in light of the IPCC carbon budgets, available at http://gdrights.org/gdrs-scorecard-calculator-information/mitig-path-overview/

Government of Norway,2013. Norwegian Fast Start Finance Report, submitted to the UNFCCC Secretariat, 8 August. http://unfccc.int/files/cooperation_support/financial_mechanism/fast_start_finance/application/pdf/norwegian_fast_start_finance_report_2012final08august13.pdf

WRI/ODI/CICERO, 2013. Authors: Thorvald Moe, Steffen Kallbekken, Smita Nakhooda, Taryn Fransen, and Alice Caravani. The Norwegian Fast-Start Finance Contribution.

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