

TIME TO STOP DIGGING

WHY GERMAN CLIMATE LEADERSHIP REQUIRES A RAPID PHASEOUT OF FOSSIL FUEL PRODUCTION AND FINANCE

NOVEMBER 2017



 OILCHANGE
INTERNATIONAL

In collaboration with

 350.org

This report was researched and written by Kelly Trout, Hannah McKinnon, Alex Doukas, Greg Muttitt, and Allison Lee. It was edited by Susan Rubinstein. All are with Oil Change International.

The author is grateful for feedback from the following reviewers:
Hans Verolme, Tim Ratcliffe, Regine Richter, and Lili Fuhr.

Design: paul@hellopaul.com

Cover Image: Open lignite coal mine in Cottbus-Nord. ©A. Gutwein.

<https://creativecommons.org/licenses/by-sa/3.0>

November 2017.

Oil Change International is a research, communications, and advocacy organization focused on exposing the true costs of fossil fuels and facilitating the coming transition towards clean energy.

Oil Change International
714 G Street SE
Suite #202
Washington, DC 20003 USA
www.priceofoil.org

In September 2016, Oil Change International and partners published *The Sky's Limit: Why the Paris Climate Goals Require a Managed Decline of Fossil Fuel Production*. The report found that burning the oil, gas, and coal in already-producing fields and mines would be enough to take the world beyond 2 degrees Celsius of warming; therefore, meeting the Paris goals requires an end to new fossil fuel development.

This is one of a series of national briefings that consider the conclusions of that work and apply the same methodology at a country level, in this case Germany. For further detail on methodology and international implications, please see the original report. It can be found at:
<http://priceofoil.org/2016/09/22/the-skys-limit-report/>

CONTENTS

| | |
|--|-----------|
| Executive Summary | 1 |
| The Global Carbon Budget | 6 |
| No exploration, no expansion, and a managed decline | 6 |
| German Coal Production: A Rapid Phaseout Must Begin Now | 9 |
| Coal in Germany: incompatible with climate leadership | 9 |
| Germany must be a first-mover in early closure of existing mines and fields | 10 |
| Coal versus German climate goals | 11 |
| Box 1: Energiewende: no turnaround from coal | 12 |
| Box 2: Tentative steps forward: Germany needs to go further faster | 13 |
| Why should Germany stop mining coal before some other countries? | 13 |
| Workers and Communities at the Heart of a Just Transition | 15 |
| Principles for a just transition | 15 |
| Lessons from past German transitions: Social dialogue and early planning are keys to success | 16 |
| A rapid and socially just transition requires deep political and financial investment | 17 |
| Oil and Gas: End Exploration and Expansion to Avoid a Dangerous Detour | 18 |
| Fracking: join the club on a total ban | 19 |
| European Gas: a problem, not a solution | 19 |
| Financing Emissions Abroad | 20 |
| Box 3: Helping Shell drill deep into the U.S. Gulf, come hurricane or high water | 21 |
| Lacking transparency: The problem is even bigger than it looks | 21 |
| Germany is financing more dirty energy than green energy abroad | 22 |
| Financing coal emissions | 23 |
| Financing oil and gas emissions | 23 |
| Clean energy finance lags behind | 24 |
| Climate assistance versus fossil fuel finance | 24 |
| Conclusion | 25 |

EXECUTIVE SUMMARY

In December 2015, world governments agreed in Paris to limit global average temperature rise to well below 2 degrees Celsius, and to strive to limit it to 1.5 degrees Celsius. To achieve these ambitious and necessary aims requires a redefinition of climate leadership.

In our September 2016 report, “The Sky’s Limit: Why the Paris Climate Goals Require a Managed Decline of Fossil Fuel Production,” we analyzed what a Paris-aligned carbon budget would mean for fossil fuel production globally (Figure ES 1). In that previous report, key findings included:¹

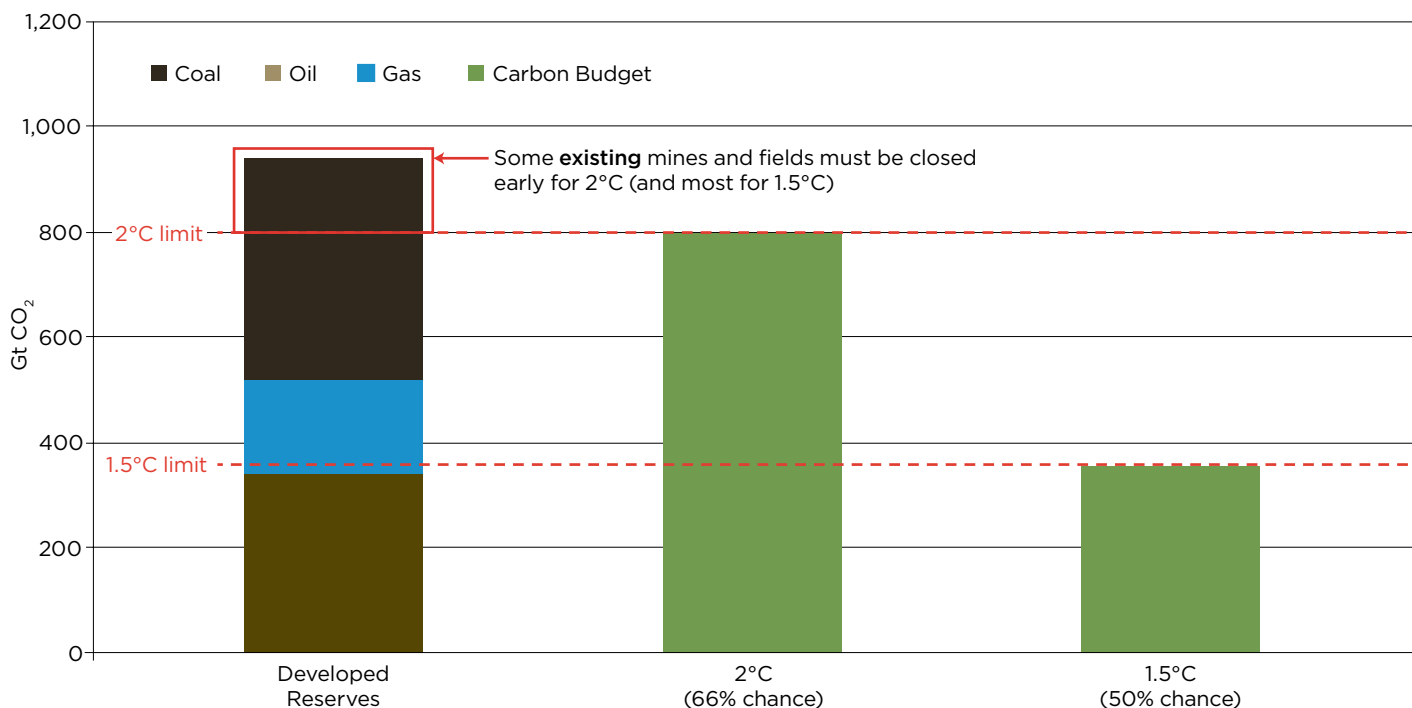
- ❖ The potential carbon emissions from the oil, gas, and coal in the world’s currently-operating fields and mines would take us beyond 2 degrees Celsius of warming.
- ❖ The reserves in currently-operating oil and gas fields alone, even with no coal, would take the world beyond 1.5 degrees Celsius of warming.
- ❖ With the decline in fossil fuel production required over the coming decades to meet climate goals, clean energy can be scaled up at a corresponding pace, expanding the total number of energy jobs.

These findings indicate that meeting climate goals will require a managed decline of the entire fossil fuel sector towards global decarbonization in the coming decades, including a just transition for energy workers and communities.

Given that the coal, oil, and gas in already-producing mines and fields around the world are more than we can afford to burn while keeping likely warming below 2 degrees Celsius – and far more than we can afford for a 1.5 degrees Celsius limit – a significant portion of existing coal mines and oil and gas fields must be closed early, before their reserves are fully depleted. Coal mining in wealthy countries rises to the top as a form of existing production that must be shut down early – and quickly – to stay within global climate limits.

Germany, for reasons that we will explore in this report, should be among those leading the way.

Figure ES1: Emissions from Developed Fossil Fuel Reserves, Compared to Carbon Budgets



Sources: Rystad Energy, International Energy Agency (IEA), World Energy Council, Intergovernmental Panel on Climate Change (IPCC)²

German Chancellor Angela Merkel has a strong rhetoric on climate change, and has realized significant diplomatic successes on climate abroad – the German press has even dubbed her the “Klimakanzlerin” (Climate Chancellor). However, in spite of impressive progress on renewables, including the globally recognized ‘Energiewende’, Germany has not reduced its emissions since 2009. The increased renewable energy generation has instead displaced nuclear or been exported. This failure can be largely attributed to Germany’s continued reliance on coal, in particular a failure to plan for a transition away from lignite mining, on which nearly 20,000 workers depend (including 5,000 in the associated power plants).^a Furthermore, Germany continues to finance emissions abroad that are incompatible with a safe climate future. As a result of this failure to demonstrate adequate ambition in curbing emissions at home, Merkel has more recently earned the moniker of “off-duty Climate Chancellor.”³

It is increasingly recognized that real climate action must address fossil fuel supply, as well as end-of-pipe emissions. For example, at the time of publication, France is in the process of legislating a complete, nationwide ban on new licensing of fossil fuel production and numerous jurisdictions worldwide have banned the practice of hydraulic fracturing of gas and oil. Political leaders are being challenged to plan for the full fossil fuel phaseout to which they have committed.

Germany’s most significant challenge will be phasing out remaining lignite mines. It will be especially difficult for workers and communities that depend on them for their livelihoods. Any equitable solution to ending coal extraction must take those people into account. In fact, ending extraction will be difficult everywhere it happens. For example, in Germany, coal miners account for 0.03 percent of the workforce and, in China, 0.6 percent of the workforce. Meanwhile, Germany has sixteen times more capacity to support workers through a rapid transition than does China, based on total wages for coal miners relative to each country’s GDP.

^a Where this report refers to “coal,” unless otherwise specified, it refers to both lignite and hard coal.

If Germany will not close its lignite mines within a short timeframe, it is hard to see which other countries can be expected to close already-operating fields or mines. The same holds true for new oil and gas development, which Germany should ban as a proactive measure.

Beyond efforts to rein in domestic fossil fuel production (and the associated emissions), Germany must extend its climate action beyond its borders by ending its support for the buildout of European gas, as well as the many billions of dollars in public finance that Germany provides for fossil fuel production abroad each year.

This report examines the implications of real climate leadership for Germany in the global context. Its key findings conclude that Germany must take the following steps domestically to credibly claim climate leadership:

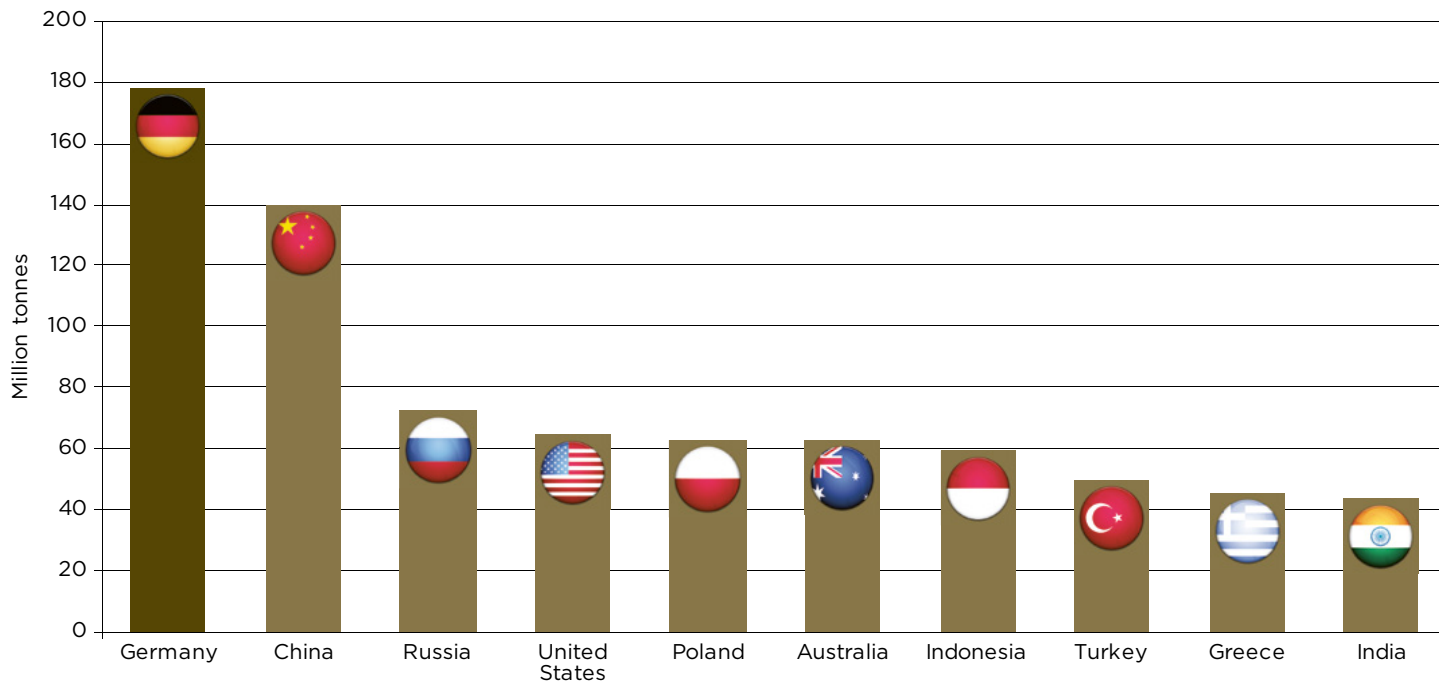
- ❖ **Close existing lignite coal mines as soon as possible, and within 10 years,** and restore the damaged land left behind. Germany is the world’s largest producer of lignite coal and is well-positioned to phase out coal (Table ES1 and Figure ES2). Morally, Germany has no right to extract more, while other countries have greater needs. Practically, we observe that the decision to phase out hard coal in 2007 - when there were 32,000 miners - set a timeframe of 11 years. With fewer workers (20,000), and greater urgency, the lignite phaseout should be significantly faster.
- ❖ **Support a credible and robust just transition.** The biggest barrier to ending coal production in Germany is the disruption it would cause to workers and people in the lignite regions; therefore, Germany’s federal and state governments must make deep investments in job creation, economic transition, and protection of workers’ rights, while putting unions and communities at the heart of crafting a vision for their regions’ futures.
- ❖ **Ban new oil and gas development.** A national ban on oil and gas exploration and expansion (including fracking) will ensure potential production does not introduce significant new sources of carbon pollution mid-century at a time when global decarbonization should be nearly complete (Figure ES3).
- ❖ **Announce a plan for a managed decline of all German fossil fuel production.** Germany is well-positioned to serve as a global role model for an effective and just managed decline of fossil fuel production towards decarbonization in the coming decades.

Table ES1: Top Ten Global Coal Producers by Human Development Index (HDI) Rank

| Country | Human Development Index | Human Development Rank | 2016 Coal Production (Million tonnes) |
|----------------|-------------------------|------------------------|---------------------------------------|
| Australia | 0.939 | 2 | 503.3 |
| Germany | 0.926 | 4 | 175.6 |
| United States | 0.920 | 10 (tied) | 671.8 |
| Poland | 0.855 | 36 | 130.9 |
| Russia | 0.804 | 49 | 365.5 |
| Kazakhstan | 0.794 | 56 | 97.9 |
| China | 0.738 | 90 | 3,242.5 |
| Indonesia | 0.689 | 113 | 460.5 |
| South Africa | 0.666 | 119 | 256.9 |
| India | 0.624 | 131 | 707.6 |

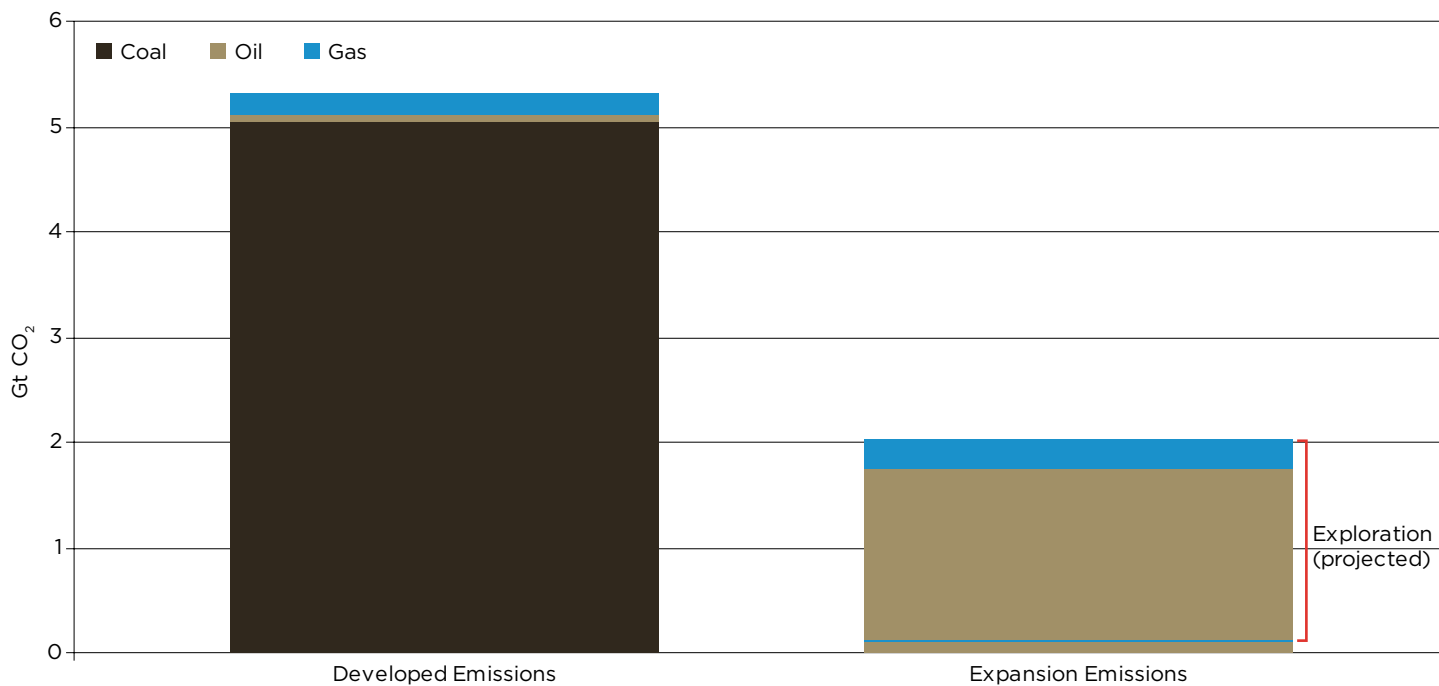
Sources: United Nations Human Development Programme (UNDP),⁴ IEA⁵

Figure ES2: Top Ten Lignite Producers Globally, 2015



Source: BGR⁶

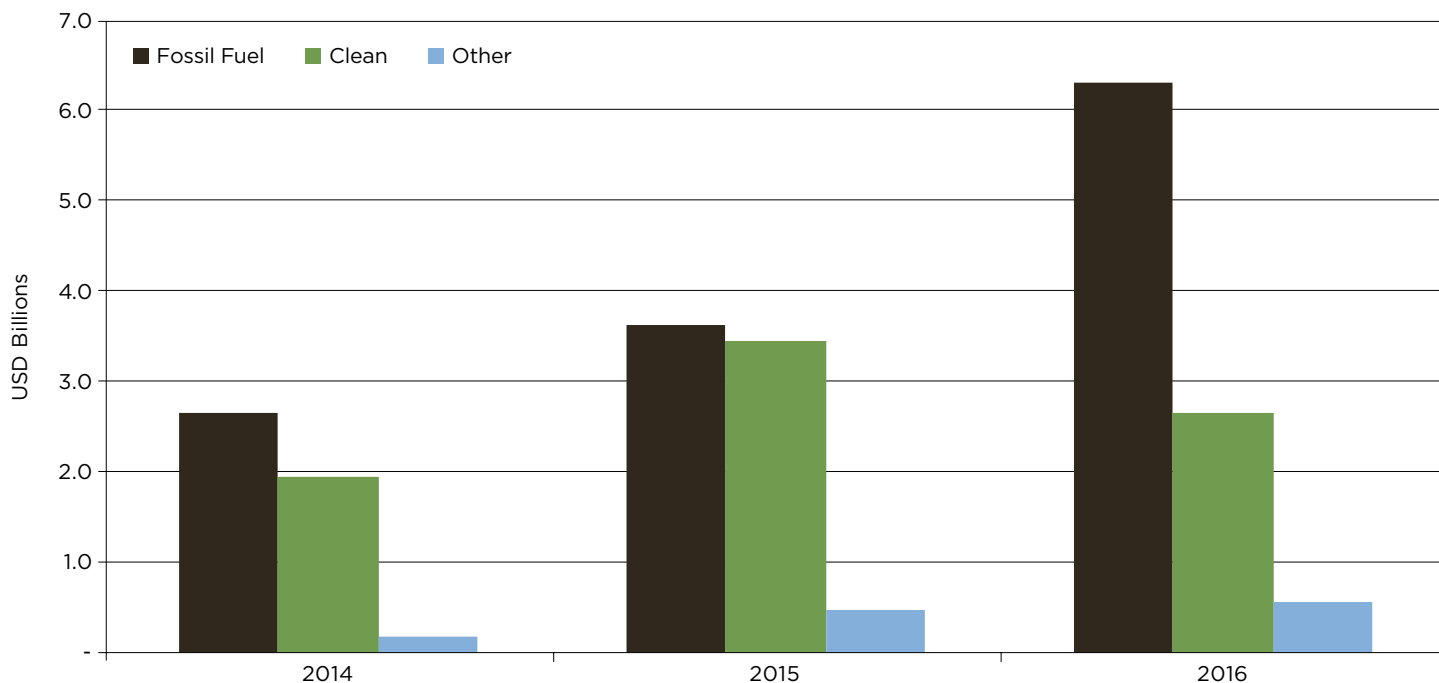
Figure ES3: Developed vs. Potential Expansion Emissions from Germany's Coal, Oil, and Gas Reserves



Sources: BGR, Rystad Energy, IPCC, UBA⁶

b Developed coal reserves include lignite in operating and planned mines, which totals about 5 Gt of lignite, as well as 12 Mt of remaining hard coal expected to be extracted from operating mines before they shut in 2018. BGR, op. cit., p. 23-25. Remaining undeveloped coal reserves, which include 31 Gt of lignite, are not considered potential expansion emissions. Developed oil and gas reserves include operating fields. Potential expansion emissions are projected from discovered reserves and possible discoveries of new oil and gas resources. Oil and gas reserves and resources data is from Rystad UCube, October 2017. Oil includes condensate and NGL. Gas includes flared gas as well as sold. For coal, reserves are converted to emissions using German emissions factors for lignite (111.3 tCO₂/TJ) and hard coal (93.6 tCO₂/TJ), which are derived from Umweltbundesamt (UBA), "CO₂-Emissionsfaktoren für fossile Brennstoffe," June 2016, Table 16. https://www.umweltbundesamt.de/sites/default/files/medien/1968/publikationen/co2-emissionsfaktoren_fur_fossile_brennstoffe_korrektur.pdf. The lignite emissions factor is derived from the emissions factors given for the four main lignite-producing regions, and weighted to 2016 production volumes from each region. For oil and gas, reserves are converted to emissions based on emissions factors from IPCC Guidelines: oil 0.42 tCO₂/bbl, gas 59,726 tCO₂/bcf. See IPCC, "Guidelines for National Greenhouse Gas Inventories, 2006, Vol.2, Chapter 1," Tables 1.2 and 1.3, http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf

Figure ES4: German Public Finance for Energy by Energy Type (USD billions), 2014 to 2016



Source: Oil Change International Shift the Subsidies Database

This report also finds that Germany must take the following steps beyond its borders to credibly claim climate leadership:

- ❖ **Revoke support for a natural gas buildout in Europe.** Germany must stop using its influence to drive an ill-informed European Union (EU) energy strategy to scale up natural gas infrastructure. Natural gas is not a bridge fuel and this gas buildout is not aligned with the Paris climate goals.
- ❖ **End public finance for fossil fuels as soon as possible and by no later than 2020.** Between 2014 and 2016, Germany contributed nearly USD 13 billion in public finance for fossil fuel expansion abroad, 99 percent of which went to oil and gas infrastructure. This compares to just USD 8 billion for clean energy finance (Figure ES4). Even after the Paris Agreement was reached in 2015, Germany provided USD 6.3 billion in public finance for fossil fuels in 2016 compared to just USD 2.65 billion for clean energy.^c
- ❖ **Scale up international climate finance.** Germany’s public finance for fossil fuel expansion is five times as much as the entire world’s spending to support climate and disaster resilience in small island developing states (such as Fiji).^d Germany must scale up climate finance while ending public finance for fossil fuel expansion and should leverage its climate finance leadership to push other countries to do the same.

To be a 21st-century climate leader, Germany must recognize that tackling fossil fuel production through action at home and abroad is as critical as tackling demand for fossil fuels. German civil society organizations and environmental leaders have been leading calls for this kind of increased climate ambition for years and these continued efforts are critical. At a time when the world already has access to more fossil fuels than the climate can afford, Germany is well-positioned to act on the above recommendations and lead the world towards a safer climate.

^c Note that approximately 83% of the 2016 fossil fuel finance was in the form of guarantees or insurance. It is also likely that both of these numbers are underestimates, as we estimate that the source database captures only half of Germany’s public energy finance due to a lack of transparency at these institutions.

^d This figure assesses Germany’s public finance for fossil fuels for the three year period from 2014 to 2016, with global development assistance for climate and disaster resilience in SIDS between 2012 and 2014. In each case, this is the most recent three year period for which data is available.

THE GLOBAL CARBON BUDGET

NO EXPLORATION, NO EXPANSION, AND A MANAGED DECLINE

The Paris Agreement, now officially in force and ratified by Germany and more than 160 other nations, sets a global temperature goal of staying well below 2 degrees Celsius above pre-industrial levels while striving to limit the increase to 1.5 degrees Celsius. Signatory nations chose these goals to create a reasonable chance of avoiding the most dangerous impacts of climate change.⁷

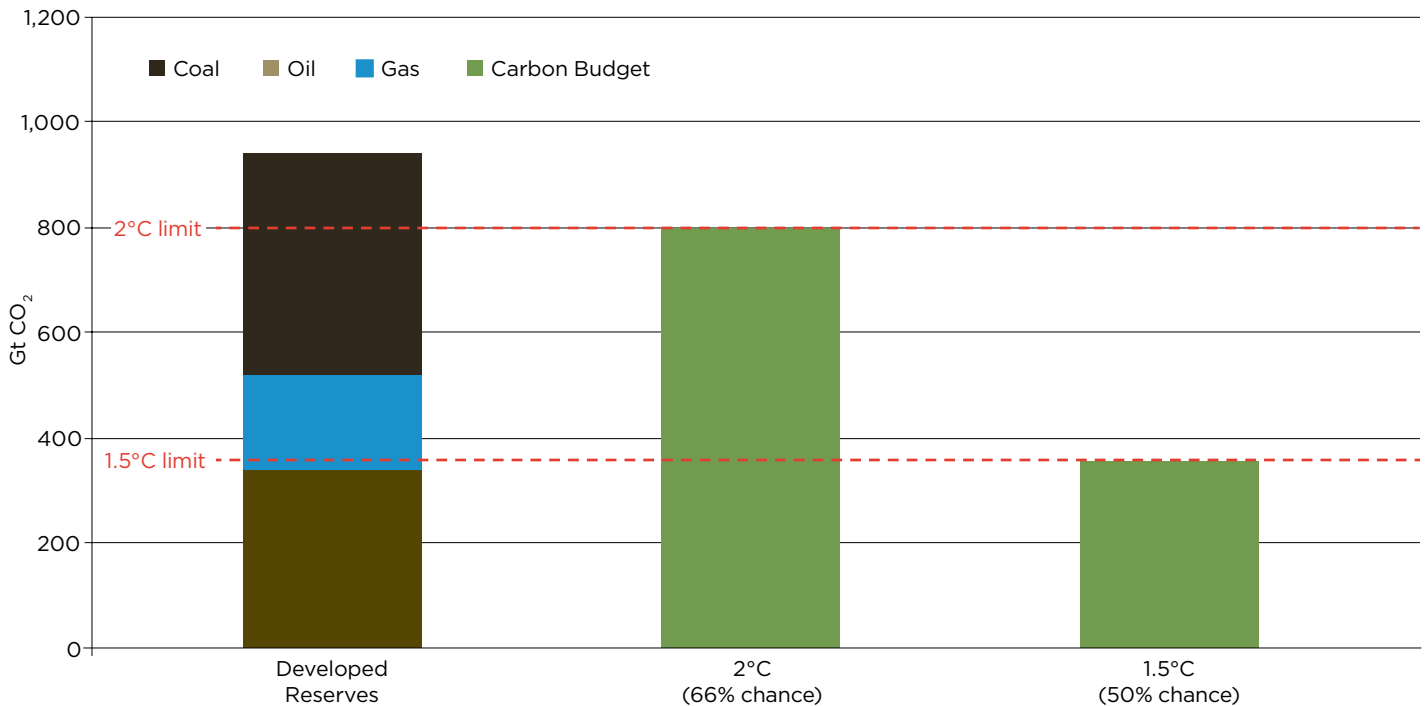
Basic climate science shows that the total cumulative carbon dioxide emissions (CO₂) over time determines how much global warming will occur. There is a set level of total cumulative emissions that can occur for a given temperature limit. This is our 'carbon budget.'^e

In our "Sky's Limit" report, we used the carbon budgets, calculated by the Intergovernmental Panel on Climate Change,^f that would give a likely (66 percent) chance of limiting temperature increases below 2 degrees Celsius and a medium (50 percent) chance of limiting

temperature increases to below 1.5 degrees Celsius – equivalent to the range of the Paris goals. We compared these budgets to the cumulative CO₂ that will be released over time from all coal, gas, and oil projects currently operating or under-construction around the world (Figure 1).⁸

The oil, gas, and coal in already-producing fields and mines are more than we can afford to burn while keeping likely warming below 2 degrees Celsius. The results show that existing oil and gas fields alone are enough to take the world beyond the 1.5-degree Celsius goal.

Figure 1: Emissions from Developed Fossil Fuel Reserves, Compared to Carbon Budgets

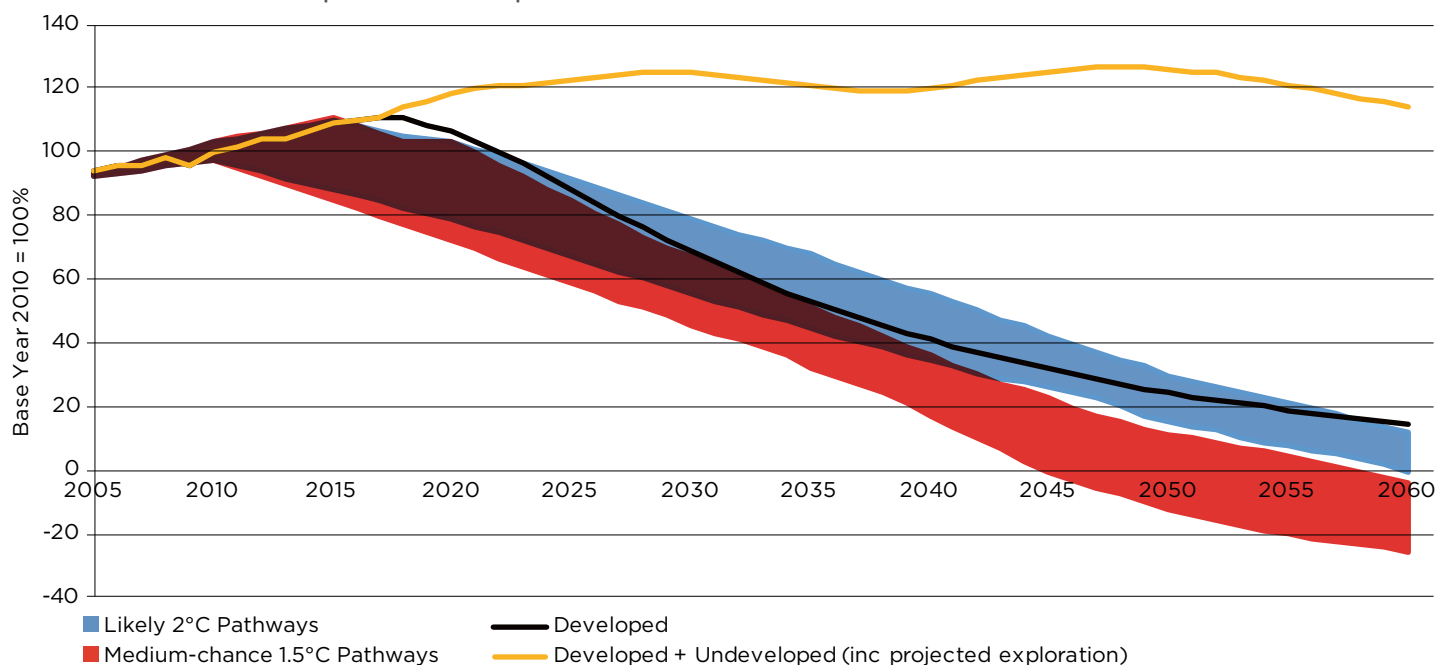


Sources: Rystad Energy, IEA, World Energy Council, IPCC⁹

^e The carbon budgets approach does not apply to short-lived greenhouse gases such as methane, whose effects are factored into the calculation of carbon budgets in the form of assumptions about their future emissions.

^f A recent study in Nature suggested carbon budgets for a 1.5 degrees goal may be higher than suggested in the IPCC report. Richard J. Millar et al. "Emission budgets and pathways consistent with limiting warming to 1.5° C". Nature Geoscience, 18 September 2017, DOI:10.1038/NGEO3031 We continue to use IPCC numbers as our principal reference, because they represent a broad agreement among the scientific community, informed by and reconciling numerous individual papers. While the new paper was peer-reviewed, some other scientists have criticized the approach. For more discussion, see Greg Muttitt, "A budge in carbon budgets?" September 25, 2017. <http://priceofoil.org/2017/09/25/a-budge-in-carbon-budgets/>

Figure 2: Rates of Change* of Global Emissions in a Range of 1.5°C and 2°C Scenarios, and of Emissions from Developed and Undeveloped Global Oil and Gas Fields



Source: Rogelj et al.,¹⁰ Rystad Energy UCube. *Rates of change are based on 2010 emissions and production levels.

Figure 2, above, compares the rates of change of global emissions needed for 1.5- and 2-degrees Celsius scenarios and global emissions from Rystad Energy’s projection of future oil and gas production.

A study by Joeri Rogelj and colleagues, published in *Nature Climate Change*, used the integrated assessment models (IAMs) MESSAGE and REMIND, and found that to keep warming below 2 degrees Celsius, current global emissions need to be reduced by half by the late 2030s, and reach zero some time around 2065. To aim for 1.5 degrees Celsius, emissions need to be halved by the early 2030s – in fifteen years’ time – and reach zero by 2050 (Figure 2). And these estimates rely on unproven negative emissions technology working out – if it does not, those cuts need to be achieved earlier.

According to climate policy orthodoxy, emissions are addressed only where they come out of the chimney or tailpipe, so Germany should be concerned about its coal power stations but not its coal mines. The theory is that once emissions are limited, markets will efficiently allocate the reduced fossil fuel demand to suppliers. Emissions are not being sufficiently limited by this approach, yet there is also a failure

to address the supply of fossil fuels. The opening of new coal mines and oil or gas fields tends to lock in their future emissions by driving down prices (since capital has been sunk) and by creating a political lobby for keeping the carbon. In the case of German coal, especially lignite, the barrier is a kind of social lock-in, where failure to address the security of workers and communities makes phasing out coal burning less palatable. In this report, we address the question of fossil fuel supply.¹¹

Some people claim that there is little point in reducing fossil fuel extraction because it will just be extracted elsewhere. Economists call this problem “leakage.” While some portion of reduced extraction does leak – it is replaced from elsewhere – that portion is not 100 percent. And, in fact, the same problem applies to reducing fossil fuel consumption: if less is burned in one place, some portion will just be burned somewhere else instead.¹² In reality, the best way to avoid all kinds of leakage is to reduce both production and consumption simultaneously.

Logically, our analysis points to three possible futures:

- ⊗ Managed decline: We succeed in restricting new fossil fuel supply projects and carefully managing the decline of the fossil industry over time, while planning for a just transition for workers and communities. This path gives us a likely chance of achieving the goals of the Paris Agreement and avoiding the worst impacts of climate change.
- ⊗ Unmanaged decline: We allow further fossil fuel development to continue, but eventually manage to limit emissions to within carbon budgets. Meeting the Paris goals would become much harder and would lead to a sudden and dramatic shutdown of fossil fuel production, which would strand assets, damage economies, and harm workers and communities reliant on the energy sector.
- ⊗ Climate catastrophe: We fail to restrict emissions. New long-lived fossil fuel infrastructure locks us into a high-carbon future that puts the Paris targets out of reach. Climate change reaches dangerous levels, causing compounding, irreparable harm for people and ecosystems around the world.

Clearly, the first option is the safest and most efficient path. By stopping new fossil fuel developments and beginning a carefully managed decline of the fossil fuel industry towards an economy powered by clean energy, we can achieve the brightest future.

This is the crux of the challenge for Germany. As we discuss below, Germany must accelerate the decline of its lignite coal sector as well as ban future exploration and expansion of oil and gas; to do otherwise would facilitate production that is incompatible with global carbon budgets.

Germany falls within a small category of regions that are wealthy fossil fuel producers who simultaneously advocate for ambitious climate action within international forums and take steps to reduce the use of fossil fuels domestically. But by failing to limit fossil fuel production and manage the sector's decline, such regions are undermining their own commitments and reinforcing incentives for the industry to continue expansion globally.

Others in a similar position include Norway, whose oil production is incompatible with

global climate goals; Canada, whose tar sands production and expansion is at cross-purposes with climate goals; and California in the United States, whose continued oil production, including via fracking, undermines other state-level climate action.^{13,14,15} All of these jurisdictions also continue to give extractive industries significant subsidies for fossil fuel production, further fueling the problem.^{16,17,18}

Open pit lignite coal mine and power plant in Jänschwalde, Brandenburg, Germany. ©Hanno Böck



GERMAN COAL PRODUCTION: A RAPID PHASEOUT MUST BEGIN NOW

COAL IN GERMANY: INCOMPATIBLE WITH CLIMATE LEADERSHIP

Despite Germany's early commitment to renewable energy through its 'Energiewende' policies, and its calls for climate leadership from rich countries, it remains a global leader in coal production. Germany is the world's eighth-largest coal producer and the top producer of lignite, the dirtiest form of coal (see Figure 3). Lignite, or brown coal, is a low-quality form of coal with much lower energy density than hard coal (which is consumed in much greater quantities globally).

The country is in the process of managing an exit from hard coal mining, which is uneconomical and has only survived through subsidies, by the end of 2018. But Germany's lignite production has remained

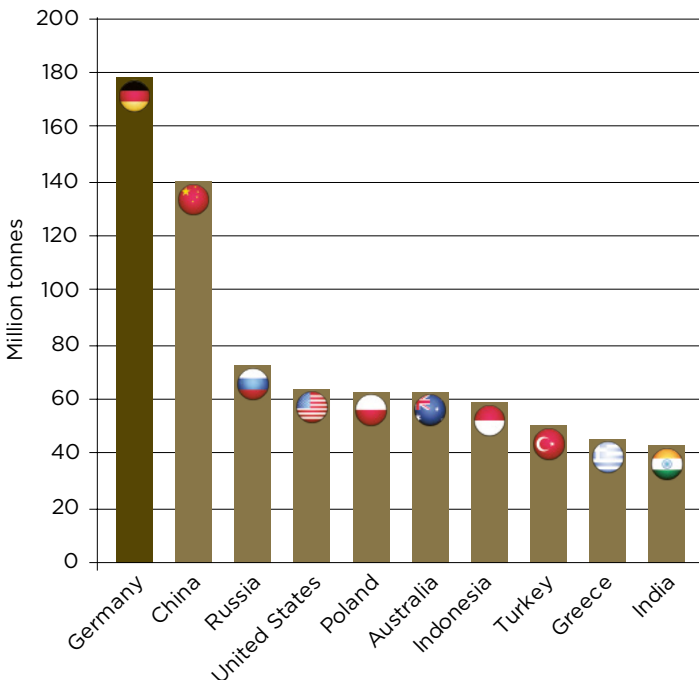
significant and steady for the past decade (Figure 4).

Lignite mining persists in three main regions – the Rhineland, Lusatia, and Central Germany (Figure 5) – through large open-pit mines that have been expanded across decades, demolishing entire towns and displacing thousands of people in the process. Nearly all German coal production is burned domestically in power plants.²¹ Coal is the primary reason Germany is Europe's largest climate polluter. Germany has the largest and dirtiest fleet of coal-fired power plants in Europe (burning both lignite and imported hard coal)²² and is still allowing construction of new plants.²³ New coal assets are at significant risk of becoming stranded due to the economics of the energy transition and policies that respond to carbon constraints.

In the Netherlands, the newly-formed government made a decision in October 2017 to phase out coal-fired power plants by 2030, including three plants that were commissioned in 2015, meaning that those plants will shut far in advance of the lifetime investors would have expected of them.²⁴

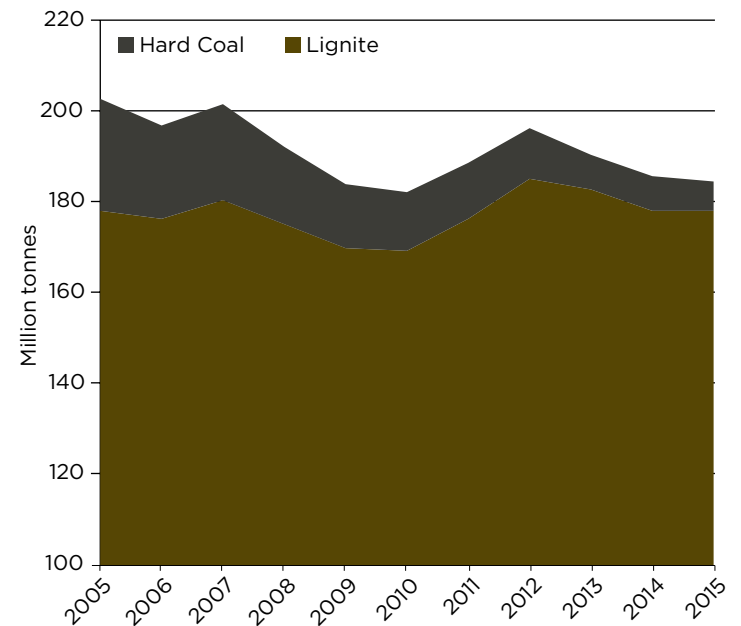
There is a growing recognition within Germany that the country's dependence on coal is incompatible with its climate commitments, and that an exit from coal will be necessary. The Ende Gelände movement,²⁵ meaning "Here and No Further," has been instrumental in forcing the issue front and center on the German political agenda. Since 2015, thousands of Germans have joined mass civil disobedience actions to shut down lignite mines and power plants, calling on leaders to stop digging and to start the country's

Figure 3: Top Ten Lignite Producers Globally, 2015



Source: BGR¹⁹

Figure 4: German Coal Production, 2005 to 2015



Source: Statistik Der Kohlenwirtschaft e.V. (SDK)²⁰

coal phaseout now.²⁶ The ambition of Germany's exit from coal is now at the center of ongoing negotiations to form a new government.²⁷

GERMANY MUST BE A FIRST-MOVER IN EARLY CLOSURE OF EXISTING MINES AND FIELDS

To understand the importance of German leadership, it's important to zoom back out to the global context. As discussed previously, the reserves of coal, oil, and gas in already operating mines and fields around the world are more than we can afford to burn while keeping likely warming below 2 degrees Celsius – and far more than we can afford for a 1.5-degree Celsius limit. As Figure 6 underscores, this means that a significant portion of existing coal mines and oil and gas fields must be closed early before their reserves are fully depleted.

The question then becomes: Who gets to extract the remaining fossil fuels that can be tolerated within climate limits? After all, since the carbon budgets are finite, each tonne of coal extracted by one country is a tonne that cannot be extracted by another country.

From a basic emissions standpoint, coal is the dirtiest fossil fuel to extract and burn for power, so coal production uses up a limited carbon budget more quickly than most forms of oil and gas. Coal mining is also the least capital-intensive form of fossil fuel production, which makes it the least costly type of production to shut down ahead of schedule.⁹ And rich coal producers like Germany have the least economic need for fossil fuel extraction, and also the greatest capacity to move first in shutting down existing mines. Compared to some poor countries, where a rapid shut-down of extraction could undermine people's right to an adequate standard of living and fundamental human needs, rich coal producers have the resources and capability to invest in a well-managed decline that protects workers and affected communities.

In fact, due to its prolific lignite production, Germany is one of only a handful of highly-developed countries that continue to be leading coal producers. As Table 1 illustrates,

Figure 5: Coal Mining Regions in Germany



among the top ten coal producers in the world, Germany ranks second-highest in the United Nations' index for human development, which rates countries' life expectancy, education, and standard of living. From this human development lens, Germany sits beside Australia and the United States as countries with the least need to maintain its existing mines.

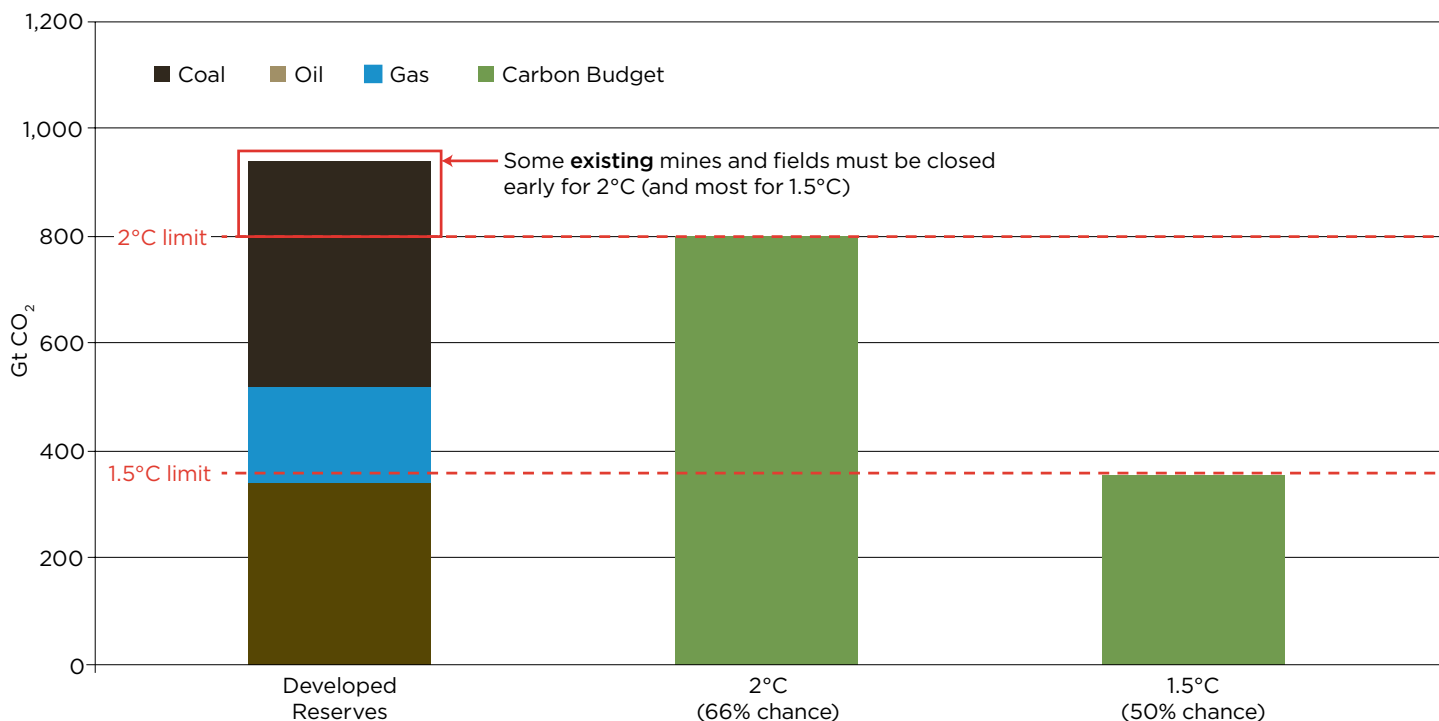
Furthermore, lignite is the most carbon-intensive source of electricity, or the "the dirtiest power generation you can imagine,"³¹ in the words of Dr. Dominik Schäuble of the Institute for Advanced Sustainability Studies. Thus its production consumes a limited global emissions budget

more rapidly than other fuels. As Figure 4 illustrates, however, Germany has yet to seriously begin a managed decline of its lignite sector.

If Germany, a country with the ambition, capacity, and resources to lead (as we will further explore in subsequent sections), cannot manage a rapid exit from coal, it begs the question of who else among the world's leading coal producers will. And if no-one shuts existing coal mines (or oil or gas fields), the world cannot achieve the Paris goals. In this way, German success could be a harbinger of global success in staying within agreed upon climate limits.

⁹ Conversely, coal mining is typically the most labor-intensive form of fossil fuel production (albeit decreasingly so, as automation drives reductions in the mining workforce). This makes planning a just transition for workers of the utmost importance.

Figure 6: Global Climate Goals Require Closing Some Existing Mines and Fields Early



Sources: Rystad Energy, IEA, World Energy Council, IPCC²⁸

Table 1: Top Ten Global Coal Producers by Human Development Index (HDI) Rank

| Country | Human Development Index | Human Development Rank | 2016 Coal Production (Million tonnes) |
|----------------|-------------------------|------------------------|---------------------------------------|
| Australia | 0.939 | 2 | 503.3 |
| Germany | 0.926 | 4 | 175.6 |
| United States | 0.920 | 10 (tied) | 671.8 |
| Poland | 0.855 | 36 | 130.9 |
| Russia | 0.804 | 49 | 365.5 |
| Kazakhstan | 0.794 | 56 | 97.9 |
| China | 0.738 | 90 | 3,242.5 |
| Indonesia | 0.689 | 113 | 460.5 |
| South Africa | 0.666 | 119 | 256.9 |
| India | 0.624 | 131 | 707.6 |

Sources: UNDP,²⁹ IEA³⁰

COAL VERSUS GERMAN CLIMATE GOALS

Germany’s ability to meet its much-touted domestic climate goals hinges in large part on its willingness to lead globally in managing an accelerated decline of existing lignite mines.

Over the past two decades, Germany has embarked on an ‘Energiewende’ process aimed at completing an energy

“turnaround,” or transition, toward reliance on renewable power, which now makes up about 30 percent of the country’s electricity mix (See Box 1). This transition is a pillar of Germany’s efforts to meet its near-term goal of reducing domestic greenhouse gas emissions 40 percent below 1990 levels by 2020 and its long-term goal of reducing emissions 80 to 95 percent below by 2050.

However, as is widely acknowledged within

Germany, the country is dangerously off-track in meeting these domestic goals.³⁶ Germany remains, by far, the largest climate polluter in the European Union (EU), responsible for a full 20 percent of total EU emissions.³⁷ While Germany has reduced its emissions by 27 percent below 1990 levels, emissions reductions have flatlined since 2009. Since 2009, emissions have remained above 900 million tonnes of CO₂e per year, and even increased slightly from 2015 to

BOX 1: Energiewende: No Turnaround From Coal

Germany has established a reputation as a first mover in energy transitions: Germany was the first country in Europe to establish feed-in tariffs for renewable energy in the 1990s,³² and Germany passed its primary Renewable Energy Law (Erneuerbare-Energien-Gesetz, or EEG) in 2000, which regulated support for renewable energy sources.³³ Building on these moves, the goals and spirit of a German 'Energiewende' were first embraced by the Merkel government following the nuclear disaster in Fukushima, Japan. Its key policy pillars include support for renewable power, primarily financed through surcharges on electric bills, the phaseout of nuclear power by 2022, and increased energy efficiency.

Notably, Germany's success in scaling up renewable power to 30 percent of its electricity mix has not coincided with a drop in coal reliance. That's because 'Energiewende' policies have largely sidestepped addressing either fossil fuel production or consumption.³⁴ In recent years, increased renewable generation has largely offset the drawdown of nuclear power or been exported, rather than leading to a commensurate decline in coal. Beyond Germany, the prices utility companies must pay for emitting CO₂ through the European Union's emissions trading system have fallen significantly since 2008, failing to discourage coal generation.³⁵ For the 'Energiewende' to fulfill its promise of a full energy 'turnaround,' it's clear that Germany can no longer put off policies that tackle fossil fuel supply head-on.

2016.³⁸ Over the same period, Germany's dependence on coal for electricity has also remained steady – hovering around 40 percent.³⁹ As overall German electricity generation has increased from 2009 to 2015, total generation from both lignite and hard coal has also increased.⁴⁰ In 2015, lignite still accounted for nearly one-quarter of Germany's electricity generation.

When it comes to lignite, Germany has so far failed to plan for a transition for lignite mine workers – thus employment issues have become a barrier to decarbonizing its energy mix. Several of the unions opposed government moves in 2015 to make the polluter pay, by levying a fee on the most polluting power stations (see Box 2), in large part because no meaningful provisions had been made to protect the affected workers. Around 5,000 workers are employed in lignite power plants, and 15,000 in lignite mines,⁴¹ which are generally tied to the power plants because it is not economical to transport the lignite elsewhere.

Within Germany, some government officials have recognized that phasing out coal will be a necessary part of achieving its climate goals. In releasing the government's "Climate Plan 2050," and reaffirming its commitment to be 'carbon neutral' by that deadline, the State Secretary at the Ministry for Environment affirmed that it is "fully

understood that coal is a story that will be over before 2050."⁴² Outgoing Environment Minister Barbara Hendricks has pushed for 2040 as a final coal exit deadline,⁴³ while other government officials have pointed to the early 2040s.⁴⁴

While government officials' belated recognition of the need to set a deadline is welcome, anything nearing a 2050 timescale is totally inappropriate. The IPCC finds that in order to keep warming to 2 degrees Celsius, global power sector emissions must reach zero by around 2050,⁴⁵ because power generation is one of the easiest areas to decarbonize. If Germany aims for phasing out coal by 2050, that would imply a rejection both of the 1.5-degrees Celsius goal, and of the central plank of global climate policy that rich countries must move faster than poor countries to decarbonize.

Furthermore, the 2050 timeline would imply that most of Germany's developed coal reserves would be extracted.^h As we noted above, if Germany cannot or will not close its mines early, it is hard to see how any country can be expected to do so, creating a likelihood that the world's developed fossil fuel reserves will push warming beyond 2 degrees Celsius.

An October 2017 report from the German Advisory Council on the Environment (SRU),

puts this policy gap in stark perspective. The Council indicated that if you ignore equity (see next section), global success in limiting warming to 2 degrees Celsius would require Germany to limit coal burning to a maximum of 10 more years at current rates; a 1.5-degrees Celsius target would reduce the timeframe to just two-and-a-half more years.⁴⁶ Taking into account Germany's historic emissions, the advisory panel concluded Germany has already exceeded its coal-burning budget.⁴⁷ A study by the NewClimate Institute found that Germany should phase out coal-fired power by 2025, and fully decarbonize its electricity sector by 2030, in order to achieve emissions reductions in line with a 1.5-degrees Celsius warming limit (as part of a wider package of emissions-reduction measures).⁴⁸

The implication is clear: As a rich country, Germany should no longer be extracting and burning coal. If Germany does not act fast, it will face one of two scenarios, both of which are avoidable: 1) It will fail to meet its short- and long-term climate commitments, thus forfeiting a position of global leadership and failing to do its fair share to address climate change, or 2) It will be forced to make up ground through a hastily planned and chaotic shut-down of coal production, leading to costs and disruption than can be avoided through a well-managed decline.

^h Lignite reserves in operating and planned mines amount to 5 billion tonnes. Production in 2016 was 172.5 million tonnes. Thus the operating and planned mines would last for 29 years at current rates of extraction. Statistik der Kohlenwirtschaft e.V., "Braunkohlenförderung", 2017. <http://www.kohlenstatistik.de/19-0-Braunkohle.html> BGR, Energy Study 2016. Reserves, Resources and Availability of Energy Resources, December 2016, pp. 23-25. https://www.bgr.bund.de/EN/Themen/Energie/Downloads/energiestudie_2016_en.pdf?__blob=publicationFile&v=2

BOX 2: Tentative Steps Forward: Germany Needs to Go Further Faster

In recent years, Germany has taken small steps to curtail coal production. Hard coal mining in Germany, which is already minimal, is projected to end in 2018, when subsidies for its production end.⁴⁹ Germany passed a law in 2007 to phase out these subsidies, in part to align with EU policy.⁵⁰

Preliminary steps to curtail lignite production have emerged only in the past two years. In 2016, the government of North Rhine Westphalia, which oversees Germany's most prolific lignite mines, nixed plans for an additional expansion of RWE's Garzweiler mine in the 2030s, which reduced reserves slated for extraction by approximately 400 million tonnes. This was the first time a state government had scaled back a previously-approved lignite mining plan.⁵¹ This followed a federal government decision in 2015 to transition eight lignite-fired plants totaling 2.7 GW of capacity to a reserve status and shut them down by 2021, a step taken to begin addressing the country's shortfall in meeting its 2020 climate target.⁵² However, the plan itself was a concession to utilities: the government is paying companies to put the plants on standby in lieu of an original proposal to levy a 'climate fee' on top polluters.⁵³

Meanwhile, leading coal companies continue to challenge climate policies, and position themselves for further bailouts. RWE, Germany's top lignite producer, was a leading opponent of the 'climate fee' proposal, and has said it fully intends to extract all of the lignite it is currently permitted to mine through mid-century.⁵⁴ In the Lusatia mining region, the Swedish company Vattenfall recently sold its loss-making lignite operations to the Czech company LEAG. LEAG announced in spring 2017 that it will scale back planned expansions of mines at Jaenschwalde and Nochten, while placing blame on the government's climate plan.⁵⁵ LEAG's decision to acquire the unprofitable lignite assets may have been a "subsidy play" for compensation payments.⁵⁶

It is clear that existing policy measures will not facilitate the decline of lignite production at the pace and scale that's needed. A rapid phaseout plan for lignite production is needed to manage the decline of the industry in line with climate limits.

WHY SHOULD GERMANY STOP MINING COAL BEFORE SOME OTHER COUNTRIES?

It is well understood in climate politics that the wealthy, developed countries must take greater and faster action than poor and developing countries. This idea is enshrined in the the UN Framework Convention on Climate Change of 1992, in which governments agreed that countries should contribute according to their common but differentiated responsibilities, and respective capabilities. In simple terms, this means that the greatest share of effort to address climate change should be carried by those countries that did the most to cause the problem, and by those most able to contribute.

Researchers Sivan Kartha, Tom Athanasiou and Paul Baer have developed a framework, known as the Greenhouse Development Rights, for informing how much different countries should cut their emissions, based on these principles.⁵⁷ If Germany were to contribute its fair share of global emissions reduction – taking into account its share of responsibility for past emissions, and its capacity to reduce emissions compared to other countries – its total emissions from all sources would (in theory) need to reach zero by 2026 for the world to keep warming

below 2 degrees Celsius, or 2024 if aiming for 1.5 degrees Celsius.⁵⁸ To the extent Germany continued emitting beyond that date, it should make significant financial contributions to poorer countries (both to compensate for the damage caused by its excessive pollution, and to enable those countries to make up for Germany by reducing their emissions by more than their fair share). Phasing out coal power generation is one of the easiest measures Germany can take to reduce emissions, as ample alternatives are available, and therefore it should happen sooner than the more difficult reductions in agriculture, homes, industry or transport.

While the Greenhouse Development Rights aim to inform the international political process on climate, which focuses on emissions where they occur at the end of the pipe, there is no comparable framework relating to fossil fuel extraction. Together with Sivan Kartha (now with the Stockholm Environment Institute), Oil Change International is currently developing thinking on how equity considerations relate to extraction. These discussions are at an early stage, but we can conduct a thought experiment on how fast German coal extraction should be wound down.

Phasing out Germany's remaining lignite mines will be difficult. It will be especially difficult for the 15,000 miners who work in them, for the 5,000 who work in the power stations they supply, and for others in the regions whose economies depend on lignite. Any equitable solution to ending coal extraction must take those people into account. In fact, ending extraction will be difficult everywhere it happens. Perhaps then it would be fair to give more leeway to those for whom it is hardest, or conversely for the phaseout to happen more quickly where it is least difficult.

One element of a phaseout that necessarily takes time is structural change in the economy. There is a finite proportion of any economy that can realistically and stably be redirected in a given time period. As a first approximation then, more time should be given to countries or regions that are more dependent on coal extraction. Let's compare Germany with China, the world's largest producer of coal. Detailed statistics are difficult to obtain for Chinese coal, but we can give a rough sketch.



Coal-fired power plants in Germany. ©Stodtmeister

Germany's 15,000 coal miners account for 0.03 percent of the workforce (or 1 out of every 3,000 workers).⁵⁹ In China, the 5.2 million coal miners account for 0.6 percent of the workforce (or one out of every 150 workers).¹ Assuming each country moves at the same pace in transition of its economy and workforce, China would then need twenty times as long as Germany to make the transition. For the world to reduce emissions to zero within the next 25 to 50 years, Germany would need to phase out coal mining within a year or two to move at an equivalent pace.

In either case, Germany or China, the economy will need to be transformed faster than it would naturally evolve. So, what capacity do the two countries have to compensate and support workers during

an accelerated transition? Assuming all of the mining workers in each country earn an average miner's wage, and setting aside the question of whether a Chinese miner should be "worth less" than a German one, the total coal mining wage bill is 0.03 percent of GDP in Germany, compared to 0.5 percent in China.¹ This suggests that Germany is sixteen times more able to support its coal miners through a transition than is China.

However we look at it, Germany's challenges in phasing out coal are more surmountable than those of less developed, less wealthy countries. Based on moral principles alone, Germany's coal should be phased out immediately, or within a couple of years at most, if the world is to achieve the Paris goals.

The question is then just one of what is reasonably achievable, perhaps compensated by a significant increase in Germany's climate finance. In 2007, when Germany decided to phase out hard coal subsidies (and hence hard coal mining), it had 32,800 workers in the hard coal sector,⁶⁰ and set an 11-year timeline. With a smaller number of workers in lignite, and a greater urgency, clearly the timeframe for phasing out lignite mining must be significantly shorter than 11 years.

i For comparability, we count only mining employees, assuming the mining share of total lignite employment remains at 75%, as it was in 2008, the last year for which lignite mining and power plant statistics were recorded separately. Total labor force from <https://data.worldbank.org/indicator/SL.TLF.TOTL.IN> Feng Hao, "2.3 million Chinese coal miners will need new jobs by 2020," August 7, 2017, <https://www.chinadialogue.net/article/show/single/en/9967-2-3-million-Chinese-coal-miners-will-need-new-jobs-by-2020> China is currently rationalizing its coal mining. As this article reports, potentially 2.3 million coal miners could lose their jobs by 2020. Even after this, and assuming those workers' rights have been protected, coal miners would account for 0.35% of the Chinese workforce, more than ten times the share in Germany.

j Average mining and quarrying wages in 2015: USD 795/month in China; USD 4,985/month in Germany. ILO Statistics, Mean nominal monthly earnings of employees by sex and economic activity -- Harmonized series, <http://www.ilo.org/ilostat/> Hence the total coal mining wage bill is USD 900 million per year in Germany, and USD 50bn in China.

WORKERS AND COMMUNITIES AT THE HEART OF A JUST TRANSITION

As we saw in the previous section, a rapid yet managed decline of German coal mining and combustion is crucial for the achievement of the Paris climate goals. However, it will profoundly affect thousands of workers and their families, who depend on coal. Protecting their rights must be at the heart of the transition.

Coal workers, after all, have made an important contribution to the German economy. The government must recognize their hard work, and ensure they have a meaningful role in the future economy too. This means not only the existence of jobs, but decent jobs, with fair pay and reasonable conditions, as well as functioning local economies that do not leave coal communities behind. Abandoning those workers would not only be grossly unjust, it would strengthen opposition to the energy transition, and bolster reactionary politics more broadly.

Within a national context, the numbers of affected workers are relatively small. Around 20,000 people work in lignite mining and power plants,⁶¹ out of a national workforce of about 45 million.^k 7,500 people work in the remaining hard coal mines, which are scheduled to close in 2018.⁶²

However, it is at a more local and regional level that the impact of transition is really

felt, as within the mining regions, coal is the mainstay of the economy. In Rhineland (in the state of North Rhine Westphalia) and Lusatia (in Brandenburg and Saxony), lignite is a major employer. In Lusatia, for example, about 2 percent of regular jobs are in lignite, and up to 4 percent if indirect employment (by suppliers) is counted too.⁶³ The lignite regions already have unemployment levels above the national average, compounding the importance of a just transition.^l

Undergoing a transition is not easy for any region, nor for any worker. At the very least, it means disruption, and worse, risks undermining the economic basis of the region, or offering little to workers whose skills, developed over a lifetime, are no longer required. These uncertainties are severely unsettling for those who depend on coal to feed their families. Nor is a guarantee of compensation or state support alone enough to address these concerns, in contrast to the dignity associated with work. Less obviously than the coal miners themselves, the transition will also affect the indirect workforce, from mechanics to taxi drivers, whose positions are often more precarious than well-unionized coal jobs. There are also cultural impacts; although cultural ties to open-cast lignite mining are perhaps weaker than those to deep-mining, it remains a key part of the regions' identities.

However, serious planning and proper investment in the transition by federal, state, and local governments – together with trade unions and communities – can minimize hardships for workers and communities, and even create benefits. For example, it is well-known that renewable energy is far more labor-intensive than fossil fuels: Today ten times as many Germans work in renewables as in coal.⁶⁴ A transition to clean energy can improve people's health by reducing air and water pollution, and it can make a community more resilient to the unknown changes the future brings.

PRINCIPLES FOR A JUST TRANSITION

Since the 1990s, trade unions worldwide have developed a set of principles on how to conduct a just transition. At COP 21 in Paris, German trade unions pressed hard for an ambitious and effective deal, to ensure warming does not exceed 2 degrees Celsius and to enable a planned transition with decent work and just transition at its heart, alongside adequate finance to help developing countries adapt to climate impacts.⁶⁵ Together with other unions from around the world, they were successful in gaining recognition of the importance of just transition in the preamble of the Paris Agreement.⁶⁶ Months earlier, the International Labour Organization had adopted guidelines on just transition.⁶⁷

^k The German Lignite Association (DEBRIV) estimates that 50,000 jobs depend on lignite when suppliers are also included; while this number is unverified, even if correct it would take lignite-dependent jobs to about 0.1 percent of the German workforce.

^l According to EU statistics, in February 2017, unemployment rates were 8.1% in Brandenburg, 7.6% in Saxony and 7.7% in North Rhine Westphalia (the three states containing the major lignite regions), compared to a national average of 6.3%. EURES, Labor market information: Germany, <https://ec.europa.eu/eures/main.jsp?acro=imi&lang=en&countryId=DE&catId=57&parentId=0>

Key elements of a just transition include:

- ⊗ **Sound investments** in low-emission and job-rich sectors and technologies;
- ⊗ **Social dialogue** and democratic consultation of social partners (trade unions and employers) and other stakeholders (such as communities);
- ⊗ **Research and early assessment** of the social and employment impacts of climate policies;
- ⊗ **Training and skills development** to support the deployment of new technologies and foster industrial change;
- ⊗ **Social protection** alongside active labor market policies; and
- ⊗ **Local economic diversification plans** that support decent work and provide community stability in the transition.

Crucially, unions and communities must play a key role in shaping the transition. While the necessary pace of transition is determined by science, the goals of the transition, the vision for the future economy, the strategy for getting there, and the support needed must all be actively developed by and with residents of affected regions. Indeed, a recent study of transitions away from coal in five other countries found that active dialogue and regional / local ownership were key determinants of success.⁶⁸

LESSONS FROM PAST GERMAN TRANSITIONS: SOCIAL DIALOGUE AND EARLY PLANNING ARE KEYS TO SUCCESS

Germany has experienced the trauma a rapid economic transition can entail, with the economic collapse in the East that followed reunification. Even as the federal government pumped hundreds of billions of marks/euros into the eastern economy, unemployment exceeded 20 percent by 2005.⁶⁹ The number of lignite miners in the

former DDR plummeted from 130,000 in 1990 to 73,000 in 1992, and to 29,000 in 1997,⁷⁰ a 78 percent reduction in just seven years. With that pace of change, and no chance to plan in advance, government efforts to ease the transition - for example, through an early retirement program, a phased redundancy plan, retrainings, and creation of an agency to clean up the former mines, employing 20,000⁷¹ - were inevitably insufficient. Eastern unemployment has fallen since its 2005 peak, but remains higher than in the West, while wages are lower. Rural areas especially have lost jobs and young people. The social consequences can be seen in the rise of the far-right in eastern Germany,⁷² and a legacy of fears about further decline of coal.

On the other hand, Germany has also experienced how structural change can be handled well. In the Ruhr Valley in North Rhine Westphalia, Germany has overseen one of the world's more successful industrial transitions.

When West German coal production became uncompetitive in the 1960s and 1970s, the government explored various transition strategies. In particular, it invested in supporting the Ruhr Valley, the heartland of the industry. The Government provided funds for early retirement for older workers, wage subsidies, and retraining and recruitment support for younger ones, while investing in economic diversification and redevelopment in the regions. Today, the Ruhr region has a significantly diversified economy, with tourism focused on cultural attractions (including those celebrating the industrial legacy that underpinned society for over a hundred years), new universities, and technology investments, especially in the renewable energy industry.⁷³ According to some accounts, the universities were key to creating a new source of regional pride, while also generating a highly-skilled workforce for the new industries.⁷⁴

For the most part, the transformation of the Ruhr was developed through an active social dialogue with unions, in particular the

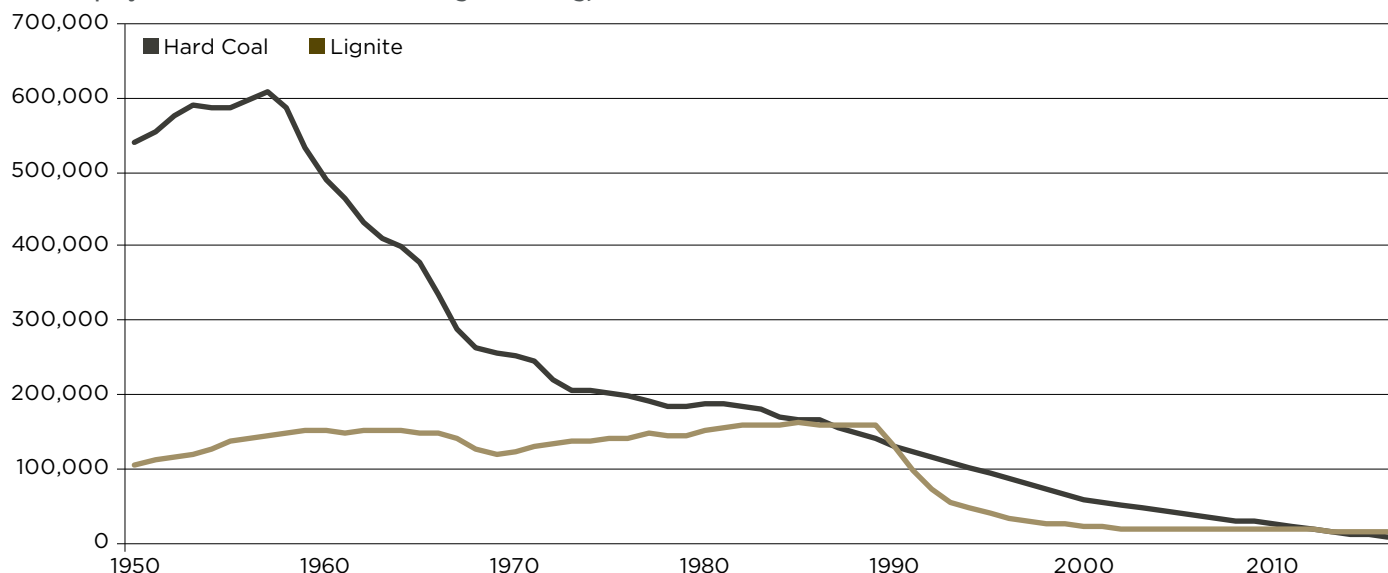
mining union IGBCE. Workers recognized the inevitability of the change, and were willing to accept the insecurity - in many cases losing their jobs - in exchange for rigorous employment-protection policies. Meanwhile, vocational training centers achieved an 80 percent success rate in placing trainees in new jobs.⁷⁶ One criticism that has been made of the process was that government was slow to take key decisions in the early phases, taking on a more dynamic leadership role only in the 1980s.⁷⁷

Some of these lessons were incorporated into the final stage of the transition away from hard coal, which was formalized in 2007 with a decision to phase out subsidies by 2018 (which will make the mines unviable). As a result, the unions have seen the transition as "socially acceptable," with most of their members (including coal workers) supporting the phaseout.⁷⁸

The transition that remains is in fact relatively modest compared to what has come before. The number of coal workers in Germany peaked at over 750,000 in 1957; in the subsequent ten years it fell by 325,000, and then by another 90,000 in the subsequent ten years. And in every ten-year period since then, the number of coal workers has fallen by more than 20,000.⁷⁹ One reason for this is competition from cheaper foreign coal, but another is changes in industrial practices: while German production has fallen by 62 percent in the last sixty years, the workforce has fallen by 96 percent (hard coal and lignite combined). Even setting aside the complete closure of the more labor-intensive hard coal mining, 60,000 lignite jobs have been lost due to mechanization over that period (see Figure 7).⁸⁰

One other lesson from past transitions is that early planning is a determinant of success.⁸² Delay leaves the problem more entrenched and forces a faster and more disruptive rate of change on workers. A more foresighted government would have started the transition away from lignite many years ago, alongside hard coal. As it

Figure 7: Employees in German hard coal and lignite mining, 1950 to 2014



Source: Statistik Der Kohlenwirtschaft E.V.⁸¹

is, an active dialogue must be conducted, along with firm decisions in the near term. For example, 29 percent of lignite workers are over 56 years of age,⁸³ meaning they are likely to reach retirement within the timeframe of phaseout or, alternatively, could be offered an early retirement package. However, 38 percent are between 46 and 55: while the higher end of the range might also be offered early retirement, many in this age range would be at risk of losing employment at an age when it is very difficult to get a new job, since employers often avoid those with less working life remaining, and whose salary needs may be higher, in spite of their greater experience.

A RAPID AND SOCIALLY JUST TRANSITION REQUIRES DEEP POLITICAL AND FINANCIAL INVESTMENT

The notion of planning a managed decline has been partly accepted at a political level: outgoing Environment Minister Barbara Hendricks said in Paris, “The time of fossil fuels – including lignite – is coming to an end. We must say this openly to people because we bear the responsibility for a well-managed structural change – in the interests of the workers and regions concerned.”⁸⁴ What is at issue is not whether there should be an orderly transition, but its pace and ambition.

We argue in this report that Germany’s transition away from coal must necessarily be rapid if the world is to have a chance of achieving the Paris goals. In order to protect the workers and communities, the political and financial investment in transition must be correspondingly ambitious; indeed, that is surely the only way such a pace can be achieved politically.⁸⁵ Think tank Agora Energiewende recommends federal government assistance of EUR 250 million per year, over twenty years, split between states in proportion to the number of lignite employees, in order to replace as many jobs as are lost.⁸⁶ For a faster transition, the annual amounts would be higher.

So far, there appears to be no shortage of money for the coal companies. In 2016, the federal government agreed to pay EUR 1.6 billion to RWE, Vattenfall, and Mibrag to compensate for their lost profits from the closure of eight lignite power plants.⁸⁷ The previous year, the government backtracked on a plan to make the polluters pay, and instead moved lignite plants into a “national capacity reserve,” at a cost of USD 2.2 to 3.3 billion per year to government and consumers.⁸⁸ This incentive well exceeds the total lignite mining wage bill, estimated above at USD 900 million (see page 14, footnote j). That is not to suggest that the government or ratepayers should

necessarily take over the wage bill, but rather to indicate the availability of funds relative to the scale of the problem – if the political will can be mustered. Subsidies that currently benefit the coal industry could be reformed and recycled to help finance elements of a just transition plan for workers.

As a wealthy, developed economy with experience in industrial transitions, Germany should set an example not only of environmental leadership but also of doing so in a socially just way. As the German Trade Union Association’s (DGB’s) Frederik Moch puts it, “We should remain a model for how climate action, socially responsible actions and prosperity can be achieved simultaneously [...] Germany has quite a lot of experience with structural change; for example, after reunification between West and East Germany, or when hard coal mining was phased out. We have seen that the state can, and must, organise and facilitate such changes [...] You cannot leave these things to market forces.”⁸⁹ Clearly, not all of those structural changes have been successful – but Moch is right that the lessons from the experiences put Germany in a strong position to lead.

OIL & GAS: END EXPLORATION AND EXPANSION TO AVOID A DANGEROUS DETOUR

Germany's oil and gas production and the related emissions are presently dwarfed by coal. The potential emissions in Germany's operating and planned coal mines exceed those in Germany's existing oil and gas fields by a factor of 19 to 1 (see Figure 8). However, based on geological and economic analysis, Rystad Energy, an oil and gas consultancy, projects possible discoveries of new oil and gas fields in Germany. If discovered and developed, these fields would pose a serious emissions threat.

At present, oil and gas production is in decline. Production from Germany's largest oil field, the Mittelplate field in the German North Sea, is expected to decline from just under 10 million barrels in 2016 to less than 5 million barrels in 2025.⁹⁰ Gas

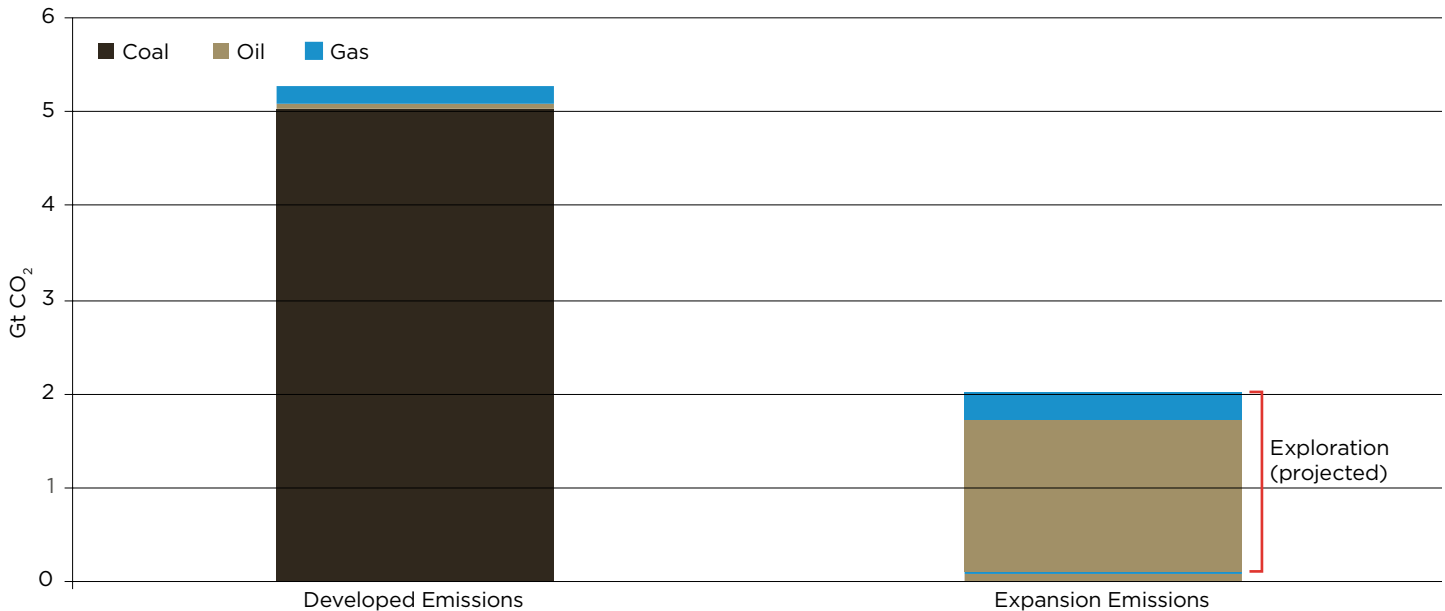
production is currently more significant: if fully tapped, German gas reserves in already-operating fields will produce three times more emissions than oil reserves in already-operating fields.⁹¹ Without the expansion of existing oil and gas fields, and barring development of any new resources, German oil and gas production is expected to decline toward minimal volumes by mid-century. As discussed previously, with equity considerations, Germany should phase out production from its developed fields as quickly as possible.

However, Germany risks veering off-track if it leaves the door open to exploration for new oil and gas resources, and if those efforts are successful. According to Rystad Energy, Germany ranks third in possible discovery of

new oil resources within Europe (excluding Russia). Rystad assessments suggest that production of future oil and gas resources in Germany (if discovered and developed) could potentially lead to eight times more emissions than remaining production from already-operating oil and gas fields. These potential expansion emissions would equal roughly one-third of the total emissions in Germany's existing coal mines and oil and gas fields (see Figure 8).

The carbon reductions from a successful German coal phaseout could be seriously undermined by potential oil and gas expansion. Germany should eliminate this climate threat now by proactively banning oil and gas exploration, and any expansion of existing fields.

Figure 8: Developed vs. Potential Expansion Emissions from Germany's Coal, Oil, and Gas Reserves



Sources: BGR, Rystad Energy, IPCC, UBA^m

^m Developed coal reserves include lignite in operating and planned mines, which totals about 5 Gt of lignite, as well as 12 Mt of remaining hard coal expected to be extracted from operating mines before they shut in 2018. BGR, op. cit., p. 23-25. Remaining undeveloped coal reserves, which include 31 Gt of lignite, are not considered potential expansion emissions. Developed oil and gas reserves include operating fields. Potential expansion emissions are projected from discovered reserves and possible discoveries of new oil and gas resources. Oil and gas reserves and resources data is from Rystad UCube, October 2017. Oil includes condensate and NGL. Gas includes flared gas as well as sold. For coal, reserves are converted to emissions using German emissions factors for lignite (111.3 tCO₂/TJ) and hard coal (93.6 tCO₂/TJ), which are derived from Umweltbundesamt (UBA), "CO₂-Emissionsfaktoren für fossile Brennstoffe," June 2016, Table 16. https://www.umweltbundesamt.de/sites/default/files/medien/1968/publikationen/co2-emissionsfaktoren_fur_fossile_brennstoffe_korrektur.pdf. The lignite emissions factor is derived from the emissions factors given for the four main lignite-producing regions, and weighted to 2016 production volumes from each region. For oil and gas, reserves are converted to emissions based on emissions factors from IPCC Guidelines: oil 0.42 tCO₂/bbl, gas 59,726 tCO₂/bcf. See IPCC, "Guidelines for National Greenhouse Gas Inventories, 2006, Vol.2, Chapter 1," Tables 1.2 and 1.3, http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf

FRACKING: JOIN THE CLUB ON A TOTAL BAN

Rystad expects over 80 percent of potential oil discovery and close to 50 percent of potential gas discovery in Germany to be in shale resources, extracted through hydraulic fracturing or fracking. While Germany has banned “unconventional” fracking until at least 2021, a complete and permanent ban on fracking is a clear way to demonstrate leadership and confirm that Germany is serious about mid-term decarbonization.⁹²

Hydraulic fracturing, or fracking is the process of injecting high-pressure water, sand, and chemicals deep underground to extract natural gas or oil. Fracking uses huge amounts of resources – a fracking well is often injected with more than a million gallons of water, chemicals, and sand at high pressure. Many of the chemicals used are toxic and several are known to cause cancer. Studies have found that between 20 to 85 percent of fracking fluids stay underground following injection where they can contaminate groundwater.⁹³

While the technology has been used for some time, public opposition to this highly invasive and destructive process has skyrocketed in recent years alongside the rapid growth of the industry. In a complete and permanent fracking ban, Germany would join various jurisdictions in the United States and Canada, as well as Scotland and France in Europe.⁹⁴

In addition to an accelerated lignite phaseout, Germany must also act assertively to ensure no continued exploration for or expansion of oil and gas reserves is permitted. While Germany’s oil and gas reserves are relatively modest, there is still significant emissions growth potential from discovery of new resources unless Germany acts to take them off the table. Germany should follow the lead of its neighbor, France, and pursue legislation to ban oil and gas expansion nationally.

EUROPEAN GAS: A PROBLEM, NOT A SOLUTION

Germany’s role in fossil fuel production extends well beyond its borders. As the EU’s largest economic power, Germany is a key driver of energy and fiscal policy at the EU level, and a major and influential shareholder in the European Investment Bank (EIB) and the European Bank for Reconstruction and Development (EBRD). In this role, the German government has promoted billions of euros of investment in natural gas infrastructure across Europe, including through the Connecting Europe Facility, the European Fund for Strategic Investments, and beyond. EIB and EBRD alone provided more than EUR 8.5 billion in public finance for gas and oil-and-gas infrastructure projects between 2013 and 2015,⁹⁵ with most of that finance supporting projects within Europe.

However, research rooted in climate science has repeatedly demonstrated that gas is not a “bridge fuel,” because to stay within the Paris Agreement’s long-term temperature goal, the power sector must rapidly decarbonize and, globally, must be carbon-free by roughly mid-century.⁹⁶ Shifting reliance from one high-carbon energy source to another is not a path to decarbonization, particularly when considering that emissions from the production and transportation of gas are potentially much higher and much more damaging to the climate than previously understood. Leakage rates along methane production, processing, transportation, and storage systems in the EU are poorly characterized. In the United States, however, one robust estimate indicates a national average leakage rate of approximately 3.8 percent of production,⁹⁷ while one tonne of methane vented or leaked to the atmosphere is 86 times more powerful than CO₂ as a driver of climate change over a 20-year period.⁹⁸

In addition, peer-reviewed research indicates that a “2-degrees Celsius capital stock” for the electricity sector will have been reached by the end of 2017. This means that “even under the very optimistic assumption that other sectors reduce emissions in line with a 2°C target, no new emitting electricity infrastructure can be built after 2017 for this target to be met, unless other electricity infrastructure is retired early or retrofitted with carbon capture technologies.”⁹⁹ This suggests that additional unabated gas-fired power capacity is incompatible with the climate limits enshrined in the Paris Agreement.

Finally, across the EU, gas demand is falling, and as of 2015 was 23 percent below its peak, with demand in key end use sectors declining.¹⁰⁰ Even the president of Eurelectric – the trade industry that represents the electricity industry in Europe – has recently questioned the economics of building new gas-fired power plants, saying that eventually, “gas also is being phased out, just like coal.”¹⁰¹ A large buildout of gas infrastructure across Europe, based on faulty demand projections that contradict current demand trends, is being driven in part by Germany. This massive dash for gas risks stranding billions of euros as a result of gas infrastructure no longer being needed due to declining demand, whether from changes in the market, strong climate policies, or both.

Germany’s leaders must confront the reality that gas is not a bridge fuel, a reality which has implications for planning not only at home, but also in Germany’s role as a major driver of EU-level policy and public finance.

FINANCING EMISSIONS ABROAD

The gap between Germany's climate leadership in international fora and lack of ambitious action to curb emissions at home has been litigated extensively in the German press, and to some degree even in international media. But another issue – one that has received much less public attention – underscores how much further Germany must go to credibly claim the mantle of climate leadership: The issue of Germany's public finance for dirty energy at home and abroad.

A wide coalition of interests has called on world leaders to end public finance and domestic subsidies for fossil fuels. In 2016, more than 200 civil society organizations called on G20 leaders, including Germany, to end public finance and subsidies for fossil fuels by 2020.^{102,103} Investors and insurers, including Actiam, Aegon Asset Management, Aviva, Legal and General and Trillium Asset Management, have repeated this 2020 phaseout demand, with their latest statement in February of 2017 representing investors and insurers with over USD 2.8 trillion in assets under management.¹⁰⁴ And in April 2017, Finance Ministers representing the V20 – some of the world's most vulnerable countries – called on all financial flows, including those of multilateral development banks, to be aligned with the Paris Agreement and its 1.5-degree Celsius temperature limit.¹⁰⁵

Germany is a major provider of public finance, through multiple channels, including government-controlled development finance institutions (such as KfW and Deutsche Investitions- und Entwicklungsgesellschaft, DEG), bilateral aid agencies (such as Gesellschaft für Internationale Zusammenarbeit, or GIZ), export credit agencies (such as Euler Hermes), and multilateral development banks (such as the World Bank and European Investment Bank). In recent years, Germany has committed to curbing some coal finance through policies for some bilateral finance including KfW group,¹⁰⁶ as well as a multilateral agreement to restrict certain export credits for coal under the Organisation for Economic Co-operation and Development (OECD). The Merkel government has also said that multilateral development banks “should clearly commit themselves to ending the financing of fossil fuel projects” in line with the Paris Agreement.¹⁰⁷

Yet, despite some positive steps on coal finance and strong rhetoric on the need to end public finance for fossil fuels, Germany is still providing billions of dollars per year for projects expanding fossil fuel production around the world. Globally, G20 governments provide an average of USD 71.8 billion per year in public finance for fossil fuels around the world, not including domestic subsidies and state-owned enterprise investment.

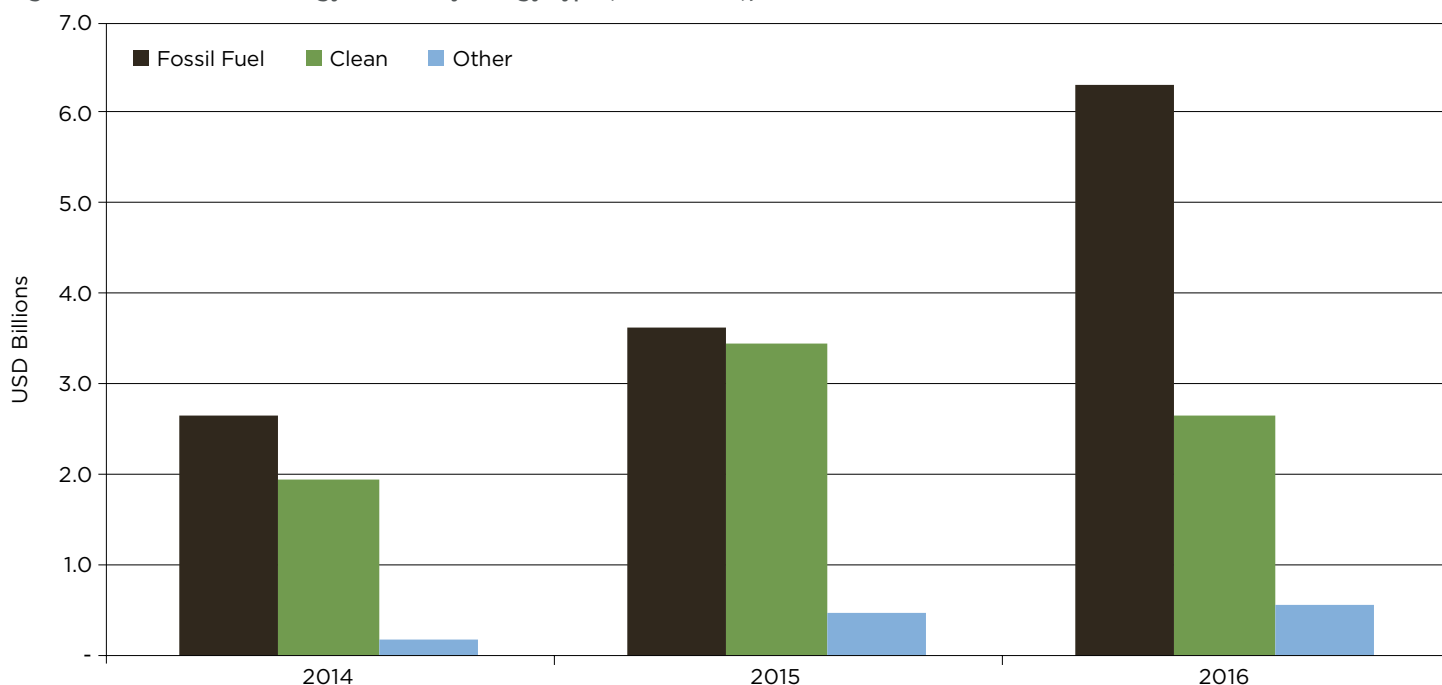
Germany plays an important part in supercharging this massive flow of public resources toward fossil fuel projects. Data from Oil Change International's Shift the Subsidies database reveals that:

- ✘ Between 2014 and 2016, Germany's public finance institutions provided at least USD 12.6 billion to fossil fuel expansion and production, the vast majority of which (99 percent) went to support oil and gas production. Meanwhile, these same institutions supported only USD 8.05 billion for clean energy over the same period (see Figure 9 for a breakdown of energy type by year).
- ✘ Even after the Paris Agreement was reached in 2015, Germany provided \$6.3 billion in public finance for fossil fuels in 2016 compared to just \$2.65 billion for clean energy.

Importantly, a lack of data access and transparency means that our analysis captures only roughly half of the estimated energy finance over the time period, suggesting that the actual figures are significantly higher. Primary data sources include publicly available documents from these public finance institutions, German government documents, and a subscription database.ⁿ

ⁿ In addition to reviewing information made publicly available by public finance institutions such as annual reports, news releases, and transaction lists, as well as other public sources of information, this database draws information from the subscription Infrastructure Journal (IJ) Global database.

Figure 9: German Public Energy Finance by Energy Type (USD billions), 2014 to 2016



Source: Oil Change International Shift the Subsidies Database

BOX 3: Helping Shell Drill Deep into the U.S. Gulf, Come Hurricane or High Water

German finance is supporting Shell’s development of the world’s deepest offshore oil and gas extraction project in the U.S. Gulf of Mexico. In 2015, KfW-IPEX extended a USD 40 million loan to help the Dutch-based SBM Offshore construct and deliver a floating production storage and offloading (FPSO) unit – a facility used to facilitate offshore oil production – called the Turrillita.¹⁰⁸ This financing provided the core infrastructure for Shell to develop the Stones field, which is located approximately 320 kilometers off the coast of the U.S. state of Louisiana.¹⁰⁹ Shell began using the FPSO in September 2016. It is the deepest offshore production unit in the world, at a depth of 2,900 meters.¹¹⁰

Shell touts the FPSO Turrillita for another reason: It is uniquely equipped for the Gulf of Mexico’s “severe meteorological

conditions.”¹¹¹ The FPSO has the world’s largest disconnectable buoy to “allow the vessel to safely sail away from oncoming hurricanes” and “quickly resume production.”¹¹²

This USD 40 million German loan is a clear example of export finance fueling climate change and inequity. The FPSO could ultimately help Shell extract over 200 million barrels of oil from the Stones field,¹¹³ which would add 91 million tonnes of CO₂ into the atmosphere. German-financed technology is helping one of the world’s richest oil companies insulate its production from intense storms, all to unlock more of the carbon pollution making hurricanes more powerful and devastating to communities unable to “sail away” from their path.

LACKING TRANSPARENCY: THE PROBLEM IS EVEN BIGGER THAN IT LOOKS

This analysis reviews energy finance from four German public finance institutions for fiscal years 2014 through 2016: Development banks KfW and DEG; export and project finance bank KfW IPEX-Bank; and a private company, Euler Hermes, mandated to manage the German government’s export credit scheme. The data are drawn from Oil Change International’s Shift the Subsidies database,

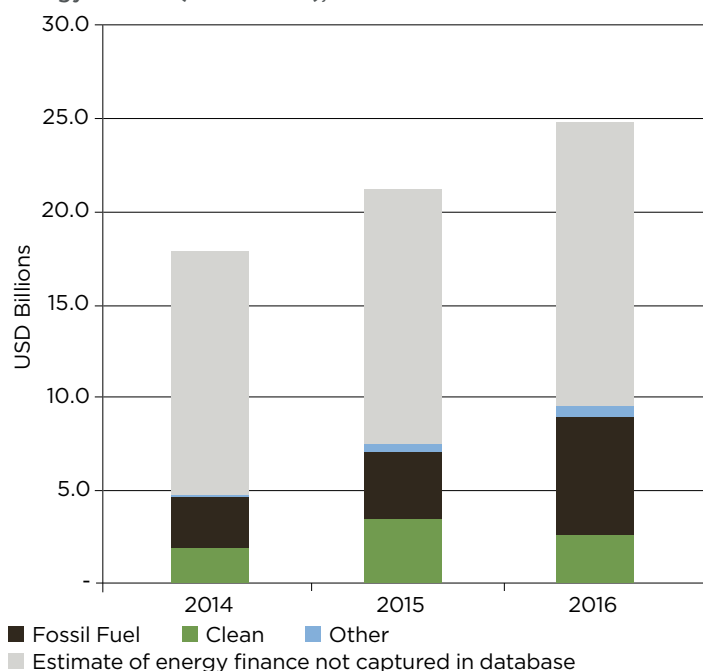
which tracks energy projects financed by multilateral development banks, bilateral development finance institutions, export credit agencies, and other state-owned banks.⁹

The data were compiled from IJ Global, institutional news releases and annual reports, and external news articles and were reviewed by German civil society organizations. While this report draws on the most recent publicly-available data, as well as some data from subscription

sources, the figures presented in this report are likely significant underestimates resulting from a lack of transparency in public finance data. A rough comparison between the aggregate figures in the Shift the Subsidies database and the aggregate figures in German public finance institutions’ annual reports suggests that the database captures roughly half of these institutions’ estimated energy finance from 2014 to 2016 (Figure 10).

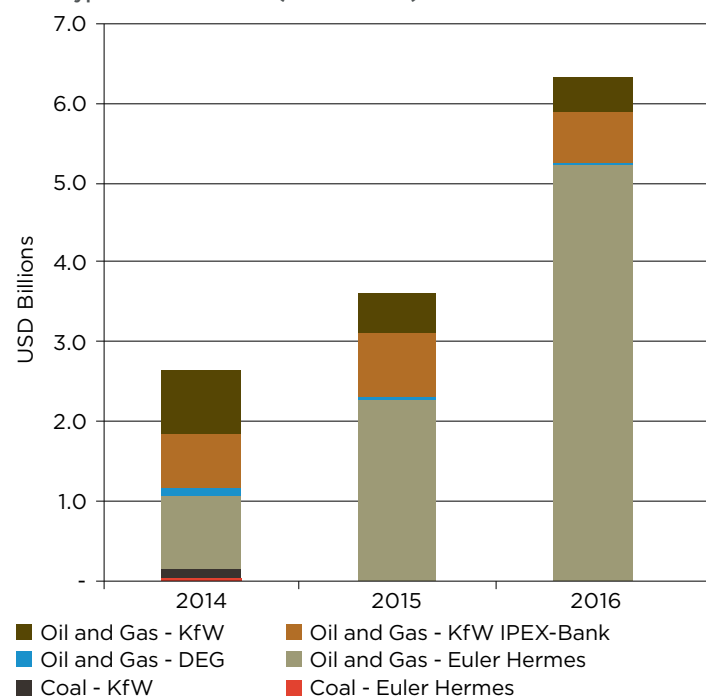
o Transactions are classified as fossil fuel (oil, gas, and coal exploration, transportation, and power projects), clean energy (sources that are low-carbon and which have low impact on the environment and communities), and other energy (projects not classified as either fossil fuel or clean, often because their impacts on the climate, environment, or communities vary substantially from project to project, including energy sources such as large hydroelectric dams, nuclear power plants, and electricity transmission infrastructure not associated with a particular energy source). More details on the classifications can be found at <http://priceofoil.org/shift-the-subsidies-methodology/>.

Figure 10: Estimated Data Gaps in German Public Energy Finance (USD billions), 2014 to 2016



Source: Oil Change International Shift the Subsidies Database; Annual reports of KfW Group, DEG, KfW IPEX-Bank and Euler Hermes^p

Figure 11: Breakdown of Fossil Fuel Finance by Fuel Type and Institution (USD billions)



Source: Oil Change International Shift the Subsidies Database

The lack of transparency on the part of German public finance institutions makes it difficult to assess the complete picture of German public energy finance. For example, some of the institutions do not make project-level data publicly available, and aggregate numbers in annual reports highlight aggregate amounts committed for environment- and climate change-related projects, but do not consistently quantify the support provided to fossil fuel industries or disclose the clients served. Additionally, the lack of transparency may mask substantive definitional differences between institutions and civil society. Examples include whether large hydropower projects, which often have negative environmental, climate, and societal impacts, are categorized as clean energy, or whether investments in the lignite coal supply chain are categorized in energy efficiency.^q

Given these significant gaps, the German government could make an important

contribution to understanding Germany's role in energy finance abroad by releasing detailed, transparent, transaction-level data about Germany's public finance transactions in the energy sector.

GERMANY IS FINANCING MORE DIRTY ENERGY THAN GREEN ENERGY ABROAD

Germany's financing of fossil fuel production and emissions abroad is strikingly inconsistent with climate leadership. From 2014 to 2016, available data show that Germany provided at least USD 12.64 billion in public finance to fossil fuel expansion and production, with the vast majority (99 percent) going to support oil and gas projects. Figure 11 displays this finance disaggregated by institution and type of fossil fuel. Unfortunately, these numbers are likely to significantly underestimate the problem due to a lack of data transparency.

During this period, about two thirds (USD 8.12 billion) of public fossil fuel support came in the form of guarantees from Euler Hermes and KfW IPEX-Bank. Most of the remainder was from loans. Of the top ten country recipients of Germany's public finance for fossil fuels, four were OECD countries, indicating that Germany is supporting fossil fuel expansion in wealthy countries. Not only is there is no space in the global carbon budget for additional fossil fuel expansion, but, as described earlier in this report, the principle of equity underlying the Paris Agreement implies that developed countries, in light of their "different national circumstances," must accelerate their emissions reductions more aggressively since emissions "peaking may take longer for developing country Parties."¹⁴

^p Based on comparisons of Shift the Subsidies figures with aggregate finance by sector figures provided in the 2015 and 2016 Annual Reports of the KfW Group, DEG, KfW IPEX-Bank, and Euler Hermes (for Export Credit Guarantees of the Federal Republic of Germany).

^q For example, KfW claimed its 2013 financing of open pit mining equipment for a lignite mine promoted energy efficiency. See CEE Bankwatch Network. The EBRD, KfW, coal and corruption: European money in the Kolubara "Environmental Improvement" project, Serbia. March 2013. <https://bankwatch.org/sites/default/files/briefing-Kolubara-12Mar2013.pdf> and KfW's position on financing coal power in Serbia: [https://www.kfw.de/KfW-Group/Newsroom/Press-Material/Themen-kompakt/Archiv-\(ab-2013\)/Serbien/index.html](https://www.kfw.de/KfW-Group/Newsroom/Press-Material/Themen-kompakt/Archiv-(ab-2013)/Serbien/index.html)

FINANCING COAL EMISSIONS

Available data suggest that coal now makes up less than 1 percent of Germany's fossil fuel finance (OCI documented USD 124 million of coal finance in 2014 to 2016, although figures from the Große Anfrage suggest coal financing is roughly 148.9 million Euro for the 2014 to 2016 period). Coal projects include KfW debt finance to coal-fired district heating projects in China and Kosovo, and a Euler Hermes loan for a coke oven refinery in India.

The reduction in Germany's international coal finance is likely due to the introduction of stricter criteria for coal finance. In December 2014, the German government released a position paper on its financing of coal-fired power plants for export/investment finance, development finance, and export credit guarantees,¹¹⁵ after pressure from German and international civil society groups.

The Government's position restricts KfW Development Bank and DEG from financing "new construction of coal-fired power stations and the retrofitting of decommissioned coal fired power stations in partner countries."¹¹⁶ The criteria for export and investment finance is looser, allowing finance for new-build coal that meets CCS pre-conditions or fuel efficiency and size requirements in countries that have a climate change mitigation policy and strategy in place. Similarly, Germany's export credit guarantees follow OECD Sector Understanding on Export Credits for Coal-Fired Electricity Generation Projects.¹¹⁷

Nonetheless, Germany continues to finance services and goods associated with coal-fired power stations. In 2016, "the Federal Government provided cover [export credit guarantees] worth around 58 million euros

for the delivery of goods and services in connection with coal-fired power stations," according to official documents.¹¹⁸

FINANCING OIL AND GAS EMISSIONS

Despite recent progress in reducing public finance for coal, Germany continues to back a large number of international oil and gas projects. Germany provided an annual average of USD 4.17 billion in public finance for oil and gas from 2014 to 2016. This finance risks locking in fossil fuel production and use for decades to come, at a time when the world – and particularly wealthier countries, where much of Germany's oil and gas finance was aimed – must transition rapidly and completely away from fossil fuels in line with the aims of the Paris Agreement. Finance that supports exploration for new oil and gas resources is particularly egregious, as it promotes the discovery of additional resources that can never be burned if the world is serious about avoiding the worst impacts of climate change.

Despite the dangers that exploration for new fossil fuel resources poses to the climate, German institutions provided an annual average of USD 420.7 million in public finance for oil and gas exploration-related projects in Azerbaijan, Brazil, Malaysia, Norway, the U.K, the United States, and Vietnam. KfW IPEX-Bank provided almost half of this finance (48 percent), followed by Euler Hermes (29 percent), and KfW Development Bank (22.5 percent).

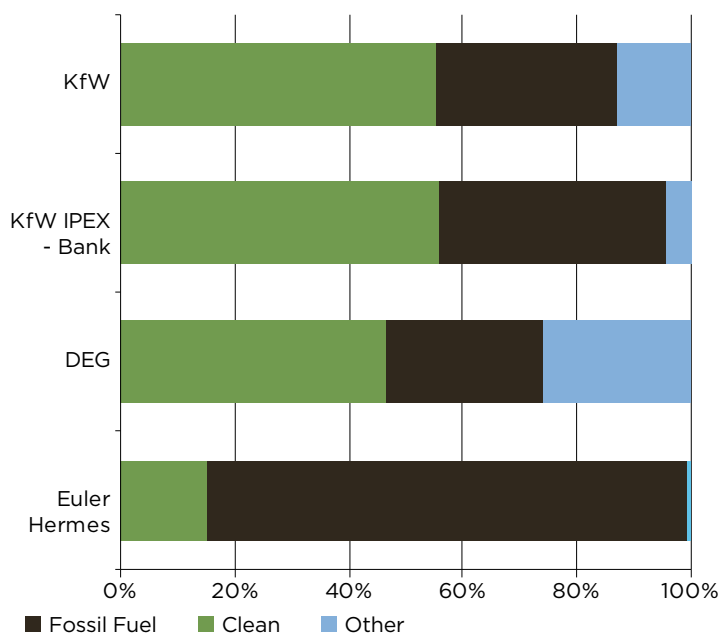
While exploration and extraction finance comprised less than 7 percent of total public energy finance over this period, nearly all of it went to high-income and upper middle-income countries for drillships, rigs, and floating production storage and offloading

(FPSO) units. Industry news and information from annual reports indicate that these vessels will be contracted to operators exploring and extracting from oil and gas fields in Angola, Azerbaijan, Brazil, Nigeria, the U.K., and the United States.

The majority of Germany's oil and gas finance came in the form of guarantees and loans for large gas-fired power plants, with finance for projects totaling roughly 26.88 GW in capacity over the 2014 to 2016 period, in countries including Egypt, Philippines, South Korea, and Turkey. Loans and loan guarantees provided by governments on preferential terms have the effect of de-risking investments and reducing the cost of capital to project developers, while placing cost and risk with the public.¹¹⁹ Without export credit guarantees backed by governments, many large fossil fuel projects would likely never be able to attract adequate investor interest. For example, Euler Hermes reported a single major EUR 2.5 billion cover transaction for a Russian gas separation plant (part of the Yamal LNG facility), which helped increase their support for oil and gas processing to EUR 2.8 billion in 2016.¹²⁰ The Russian gas separation plant was the largest single transaction for which cover was provided by the German government in 2016.¹²¹

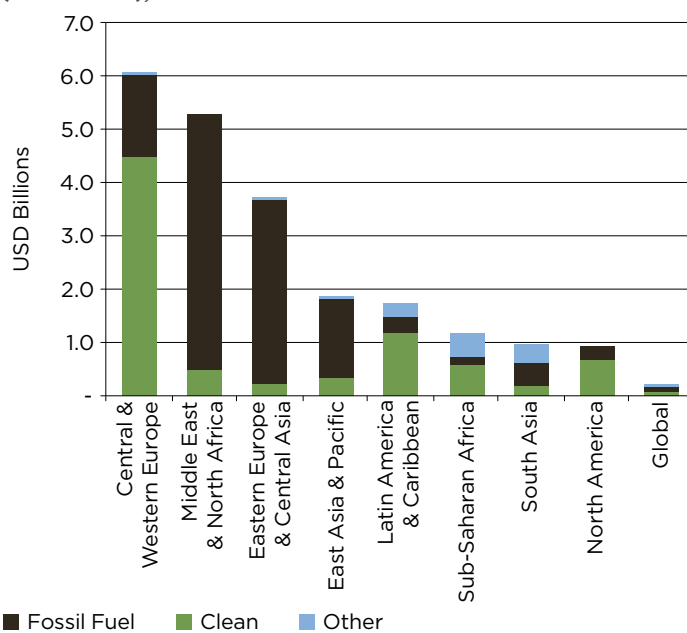
Analysis from the Global Subsidies Initiative suggests that the massive Yamal LNG project would not be possible at all in the absence of Russian government support measures, and the guarantees and insurance from other public finance institutions, including German support via Euler Hermes.¹²² This represents yet another form of subsidy. Despite the incompatibility of large fossil fuel projects with ambitious climate action, Germany's public finance institutions continue to make them possible.

Figure 12: Share of Clean Energy in Energy Finance Portfolio, FY 2014 to FY 2016



Source: Oil Change International Shift the Subsidies Database

Figure 13: Regional Breakdown of German Public Energy Finance (USD billions), 2014 to 2016



Source: Oil Change International Shift the Subsidies Database

CLEAN ENERGY FINANCE LAGS BEHIND

Despite its strong climate rhetoric, Germany provided less than half (USD 8.05 billion) of its public energy finance to truly clean energy projects from 2014 to 2016. Wind comprised the majority of clean energy finance at close to USD 6.3 billion, around 77 percent of total clean energy finance, followed by solar at USD 853 million.

About 26 percent and 25 percent of public energy finance, respectively, were in the form of loans from KfW Development Bank and KfW IPEX-Bank. Of Germany's public finance institutions, KfW and KfW IPEX-Bank also had the largest proportion of clean energy – just over half of the financial volume – in their investment portfolios over the period (see Figure 12 for the breakdown as a proportion of portfolio, by energy category and institution).

The Shift the Subsidies database indicates that over half of total clean energy finance went to projects in Central and Western Europe. In contrast, in the regions of Middle East and North Africa, Eastern Europe and Central Asia, and East Asia and Pacific, fossil fuel investments made up the majority

of German public energy finance (see Figure 13).^r

Germany's Federal Environment Minister Barbara Hendricks said in May of 2017 that "Germany will continue to support developing countries in their efforts to address climate change and its impacts." This sentiment should apply to all of Germany's public finance flows, which should rapidly be aligned with low greenhouse gas emissions and climate-resilient development, as enshrined in the Paris Agreement.¹²³ While Germany has begun to advocate for this alignment in multilateral development finance at institutions such as the World Bank, it must apply the same standard to its own bilateral public finance. Germany must commit to ending public finance for fossil fuel expansion abroad, which currently undermines Germany's own substantial climate finance. Germany's already-substantial public finance for renewable energy in developing countries demonstrates that there is a market and a demand for this financial support, and suggests that it can be scaled up.

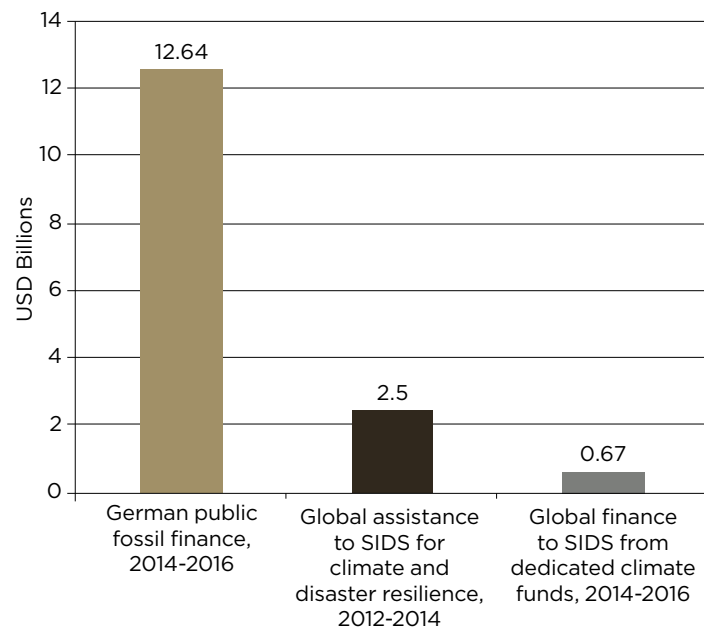
CLIMATE ASSISTANCE VERSUS FOSSIL FUEL FINANCE

While Germany is hosting the 23rd Conference of Parties (COP 23) in 2017, the COP Presidency is held by Fiji, a small island state. The Fijian COP President has stressed the importance of equity and ambition in the lead-up to this year's climate negotiations. With the question of equity and what constitutes "climate leadership" in mind, it is instructive to see how Germany's public finance to promote fossil fuel expansion abroad compares to financial support for some of the world's most vulnerable countries in the fight against climate change – the small island developing states (SIDS).

This section compares Germany's public finance for fossil fuels to global support for SIDS in the fight against climate change in two ways. First, Germany's public finance for fossil fuels is compared to total global support to SIDS for climate and disaster resilience. Second, Germany's public finance for fossil fuels is compared to climate finance flows for SIDS from the world's dedicated climate funds (18 funds operating in the SIDS that have a dedicated focus

^r As noted earlier, the large volume of financing for the Middle East & North Africa region is primarily due to two large guarantees for combined cycle gas power plants in Egypt.

Figure 14: German Public Fossil Fuel Finance Compared to Estimates of Global Climate Assistance to Small Island Developing States



Note: Data is for the most recent 3-year period for which data is available in each case. Source: Oil Change International's Shift the Subsidies database; OECD and IBRD^s; Climate Funds Update²⁴

on climate). Figure 14 summarizes these comparisons.

Germany's public finance for fossil fuels totaled USD12.64 billion during the three year period from 2014 to 2016, the most recent data available. Over the same time period, assistance to small island developing states provided by the entire world to support resilience to climate change and disasters totaled just USD 2.5 billion.¹²⁵ This means that Germany alone provided five times as much public finance for fossil fuels than every country in the world provided to small island developing states to support resilience against climate change and disasters (Figure 15).^t

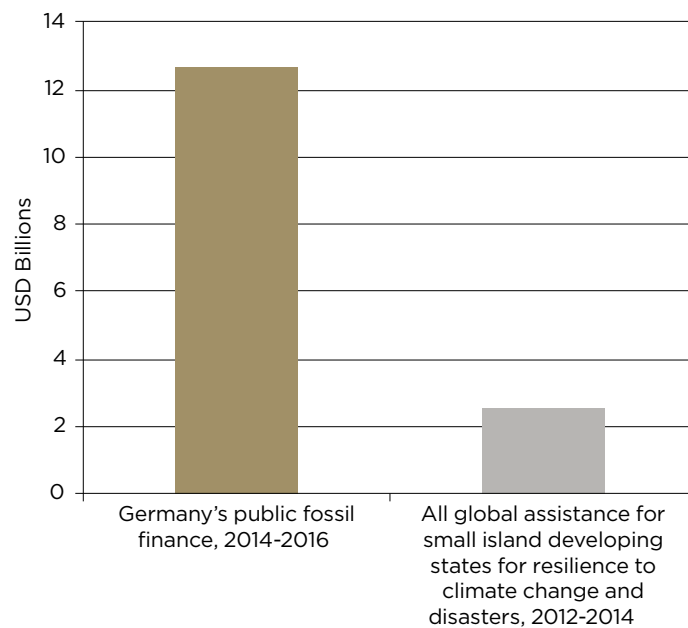
The picture is even more striking when finance from dedicated climate funds to small island developing states is compared with Germany's public finance for oil, gas,

and coal. In the thirteen years between 2003 and 2016, small island developing states received a total of just USD 1.1 billion from the world's dedicated climate funds.¹²⁶ German public finance for fossil fuels from 2014 to 2016 average USD 4.2 billion per year, compared with an annual average of just USD 83 million in finance for small island developing states from the world's dedicated climate funds – a ratio of about 50 to 1. This underscores how the scale of public resources still flowing toward fossil fuel expansion dwarf the very limited public resources available to help some of the most vulnerable countries adapt to and mitigate climate change.

In light of these findings, we conclude that Germany should:

- ⊗ Immediately end public finance for oil and gas exploration and all remaining public finance for coal;

Figure 15: Germany's Public Finance for Fossil Fuels vs. Global Assistance for Small Island Developing States for Resilience to Climate Change and Disasters



Note: Data is for the most recent 3-year period for which data is available in each case. Source: Oil Change International Shift the Subsidies Database, and OECD & IBRD^u

- ⊗ Phase out all fossil fuel finance by 2020 and align public finance with limiting temperature increase to 1.5 degrees Celsius, in line with calls from civil society, major insurers and investors, and some of the world's most vulnerable countries;
- ⊗ Scale up public finance for the cleanest forms of energy in developing countries; and
- ⊗ Improve the transparency and availability of its public finance data. Data collection from publicly available sources and some subscription sources yielded information sufficient to capture only about half of Germany's estimated public energy finance transactions (by volume) in the Shift the Subsidies database for the period between 2014 and 2016.

^s Bilateral and multilateral flows to the 35 ODA-eligible SIDS with climate adaptation as principal and secondary objective, as well as disaster resilience finance (excluding post-disaster response). Data from OECD and International Bank for Reconstruction and Development/The World Bank. Climate and Disaster Resilience Financing in Small Island Developing States. 2016. https://www.gfdr.org/sites/default/files/publication/Final_CDRFinSIDS_20170208_webversion.pdf

^t It is important to note that the level of concessionality across different types of finance vary considerably; the actual value of a loan guarantee is much less than its gross (or face) value, compared to, for example, a grant or a highly concessional loan. It is therefore important to understand that these comparisons should not be considered a direct apples-to-apples comparison of the total value of public finance flowing to each area, but as an illustrative measure that underscores the order of magnitude of the flows. In the figures used for Germany's public fossil fuel finance in this comparison, approximately 64% of the volume is in guarantees or insurance, while the rest are loans.

^u Bilateral and multilateral flows to the 35 ODA-eligible SIDS with climate adaptation as principal and secondary objective, as well as disaster resilience finance (excluding post-disaster response). Data from OECD and International Bank for Reconstruction and Development/The World Bank. Climate and Disaster Resilience Financing in Small Island Developing States. 2016. https://www.gfdr.org/sites/default/files/publication/Final_CDRFinSIDS_20170208_webversion.pdf

CONCLUSION

Our success in tackling global climate change will be determined by the countries that define our transition off of fossil fuels and into zero-carbon economies. Germany has shown bold leadership with its 'Energiewende' and, although it is not perfect, it has played a critical role in proving that expectations for renewable energy can be met and exceeded. However, despite this leadership, Germany is poised to fall significantly short of its climate goals. There must be commensurate action to rein in fossil fuel production in order to have a chance of staying within climate limits.

The global carbon budget is finite and dwindling. As the world moves to curb its addiction to fossil fuels, both consumption and supply are going to decline. The question that must be asked is how that decline is going to be managed. Will it be fast enough to avoid unaffordable emissions and carbon lock-in? Will it ensure workers and communities are protected in a just transition? Will it recognize that financing emissions and fossil fuel production abroad are a critical part of the problem?

In the case of Germany, the opportunity for leadership is tremendous. The country has experience setting precedents when it comes to climate action. Germany is well-positioned to use its climate values and wealth to drive a just transition off of fossil fuels, and demonstrate how former fossil fuel producers can thrive in a clean energy economy.

In conclusion, we recommend that Germany:

- ⊗ Close existing lignite coal mines as soon as possible, and certainly within less than 10 years;
- ⊗ support a credible and robust just transition;
- ⊗ ban new oil and gas development;
- ⊗ announce a plan for a managed decline of all German fossil fuel production;
- ⊗ revoke support for a natural gas buildout in Europe;

- ⊗ end public finance for fossil fuels as soon as possible and by no later than 2020; and
- ⊗ scale up international climate finance.

These actions will necessitate bold and decisive action by a government on a scale not seen thus far. But the conclusions are also remarkably straightforward at their core. To keep from burning more fossil fuels than our atmosphere can withstand, we must stop digging them out of the ground at home, and we must stop financing them abroad.

Rhineland brown coal mining area. ©Haloorange



REFERENCES

- 1 Greg Muttitt, Oil Change International, "The Sky's Limit: Why the Paris Climate Goals Require A Managed Decline of Fossil Fuel Production," September 22, 2016. <http://priceofoil.org/2016/09/22/the-skys-limit-report/>
- 2 For detailed methodology see Muttitt, Sky's Limit, op. cit., Section 2
- 3 Ellen Thalma and Julian Wttengel, Clean Energy Wire, "The Story of 'Climate Chancellor' Angela Merkel," September 19, 2017. <https://www.cleanenergywire.org/factsheets/making-climate-chancellor-angela-merkel>
- 4 United Nations Development Programme, "Table 1: Human Development Index and its components," Human Development Reports, 2016. <http://hdr.undp.org/en/composite/HDI>
- 5 IEA, "Coal Information: Overview," 2017, p. 4, Table 2. <https://www.iea.org/publications/freepublications/publication/CoalInformation2017Overview.pdf>
- 6 BGR, "Energy Study 2016. Reserves, Resources and Availability of Energy Resources," December 2016, p. 144, Table 37. https://www.bgr.bund.de/EN/Themen/Energie/Downloads/energiestudie_2016_en.pdf?__blob=publicationFile&v=2
- 7 UNFCCC, Adoption of the Paris Agreement, pg. 2. <https://unfccc.int/resource/docs/2015/cop21/eng/I09r01.pdf>
- 8 For detailed methodology see Muttitt, Sky's Limit, op. cit., Section 2.
- 9 For detailed methodology see Muttitt, Sky's Limit, op. cit., Section 2.
- 10 Joeri Rogelj et al. op. cit., p. 520, and communication with Oil Change International.
- 11 See Muttitt, Sky's Limit, op. cit., Section 4 for an in-depth discussion on the topic.
- 12 Michael Lazarus et al., "Supply-side climate policy: the road less taken," Stockholm Environment Institute, October 2015. http://sei-us.org/Publications_PDF/SEI-WP-2015-13-Supply-side-climate-policy.pdf
- 13 Hannah McKinnon et al., Oil Change International, "The Sky's Limit Norway: Why Norway should lead the way in a managed decline of oil and gas extraction," August 2017. <http://priceofoil.org/2017/08/09/the-skys-limit-norway-why-norway-should-lead-the-way-in-a-managed-decline-of-oil-and-gas-extraction/>
- 14 Adam Scott and Greg Muttitt, Oil Change International, "Climate on the line: why new tar sands pipelines are incompatible with the Paris goals," January 2017. <http://priceofoil.org/2017/01/19/climate-on-the-line-why-new-tar-sands-pipelines-are-incompatible-with-the-paris-goals/>
- 15 Jean Su, "To resist Trump's climate assault, California must curb oil production", The Hill, 06/22/17. <http://thehill.com/blogs/pundits-blog/energy-environment/339028-to-resist-trumps-climate-assault-california-must-curb>
- 16 Alex Doukas et al., Oil Change International, "Talk is cheap: how G20 governments are financing climate disaster," July 2017. <http://priceofoil.org/2017/07/05/g20-financing-climate-disaster/>
- 17 Janet Redman et al., Oil Change International, "Dirty energy dominance: dependent on denial," October 2017. <http://priceofoil.org/2017/10/03/dirty-energy-dominance-us-subsidies/>
- 18 Peter Erickson and Adrian Down, Stockholm Environment Institute, "How tax support for the petroleum industry could contradict Norway's climate goals," October 2017. <https://www.sei-international.org/publications?pid=3212>
- 19 BGR, "Energy Study 2016. Reserves, Resources and Availability of Energy Resources," December 2016, p. 144, Table 37. https://www.bgr.bund.de/EN/Themen/Energie/Downloads/energiestudie_2016_en.pdf?__blob=publicationFile&v=2
- 20 Lignite production data from Statistik Der Kohlenwirtschaft e.V., "Der Kohlenbergbau in der Energiewirtschaft der Bundesrepublik Deutschland im Jahre 2015," November 2016, p. 44, Figure 29. http://www.kohlenstatistik.de/files/silberbuch_2015.pdf Hard coal production data from Statistik Der Kohlenwirtschaft e.V., "Steinkohle im Überblick 1957 - 2016," 2017. <http://www.kohlenstatistik.de/3-0-Uebersichten.html>
- 21 Federal Ministry for Economic Affairs and Energy (BMWi), "Coal," <https://www.bmwi.de/Redaktion/EN/Artikel/Energie/coal.html>
- 22 Climate Analytics, "A Stress Test for Coal in Europe Under the Paris Agreement," February 2017. <http://climateanalytics.org/files/eu-coalstress-test-report-2017.pdf>
- 23 Craig Morris, "Germany to complete yet another coal plant," Energy Transition, February 1, 2017. <https://energytransition.org/2017/02/germanys-to-complete-yet-another-coal-plant/>
- 24 Megan Darby, "Netherlands to end coal power by 2030, closing down new plants," October 11, 2017. <http://www.climatechangenews.com/2017/10/11/netherlands-agrees-coal-phase-calls-stronger-2030-eu-emissions-target/>
- 25 To learn more about Ende Gelände, see: <https://www.ende-gelaende.org>
- 26 Chase Winter, "European climate protesters take on German coal," DW, August 27, 2017. <http://www.dw.com/en/european-climate-protesters-take-on-german-coal/a-40260579>
- 27 "Germany's Greens want Merkel to shut coal power plants in any coalition," DW, September 11, 2017. <http://www.dw.com/en/germanys-greens-want-merkel-to-shut-coal-power-plants-in-any-coalition/a-40450968>
- 28 For detailed methodology see Muttitt, Sky's Limit, op. cit., Section 2.
- 29 United Nations Development Programme, "Table 1: Human Development Index and its components," Human Development Reports, 2016. <http://hdr.undp.org/en/composite/HDI>
- 30 IEA, "Coal Information: Overview," 2017, p. 4, Table 2. <https://www.iea.org/publications/freepublications/publication/CoalInformation2017Overview.pdf>
- 31 Eric Marx, "Can Germany Ditch Coal?," ClimateWire, January 20, 2016. <https://www.scientificamerican.com/article/can-germany-ditch-coal/>
- 32 Simon Evans, "The History of the Energiewende," CarbonBrief, September 21, 2016. <https://www.carbonbrief.org/timeline-past-present-future-germany-energiewende>
- 33 Stockholm Environment Institute, "Turning energy around: Coal and the German Energiewende," 2016. <https://www.sei-international.org/mediamanager/documents/Publications/Climate/SEI-DB-2016-Energiewende-and-coal.pdf>
- 34 Stanley Reed, "Germany's Shift to Green Power Stalls, Despite Huge Investments," October 7, 2017. <https://www.nytimes.com/2017/10/07/business/energy-environment/german-renewable-energy.html>
- 35 Christian Schwägerl, "A Clash of Green and Brown: Germany Struggles to End Coal," Yale Environment 360, July 7, 2015. http://e360.yale.edu/features/a_clash_of_green_and_brown_germany_struggles_to_end_coal
- 36 Benjamin Wehrmann, Clean Energy Wire, Germany heads for 'spectacular' 2020 climate target miss - study, 7 September 2017. <https://www.cleanenergywire.org/news/germany-heads-spectacular-2020-climate-target-miss-study>
- 37 Greenhouse gas emission statistics, Eurostat, June 2017. http://ec.europa.eu/eurostat/statistics-explained/index.php/Greenhouse_gas_emission_statistics#Further_Eurostat_information
- 38 Umweltbundesamt (UBA), "Greenhouse gas emissions in Germany," March 2017. <https://www.umweltbundesamt.de/daten/klimawandel/treibhausgas-emissionen-in-deutschland#textpart-1>
- 39 AG Energiebilanzen, "Bruttostromerzeugung in Deutschland ab 1990 nach Erzeugertägern," August 11, 2017. <http://www.ag-energiebilanzen.de/28-0-Zusatzinformationen.html>
- 40 Ibid.
- 41 Statistik der Kohlenwirtschaft e.V., "Beschäftigte im Braunkohlenbergbau in Deutschland," 2017. <http://www.kohlenstatistik.de/19-0-Braunkohle.html>
- 42 Bob Berwyn, InsideClimate News, "Germany Reasserts Climate Leadership, Outlines Path to Carbon-Neutral Economy by 2050," November 17, 2016. <https://insideclimatenews.org/news/17112016/germany-climate-change-carbon-neutral-economy-cop22-paris-agreement>
- 43 Eric Marx, "Can Germany Ditch Coal?," ClimateWire, January 20, 2016. <https://www.scientificamerican.com/article/can-germany-ditch-coal/>
- 44 Sören Amelang, "When will Germany finally ditch coal?," Clean Energy Wire, December 16, 2016. <https://www.cleanenergywire.org/factsheets/when-will-germany-finally-ditch-coal>
- 45 IPCC, "Climate Change 2014 - Mitigation of Climate Change", Working Group III Report, Figure 7.9, p.555. http://ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_chapter7.pdf
- 46 German Advisory Council on the Environment (SRU), "Kohleausstieg jetzt einleiten (Initiate Coal Exit Now)," October 2017. https://www.umweltrat.de/SharedDocs/Downloads/DE/04_Stellungnahmen/2016_2020/2017_10_Stellungnahme_Kohleausstieg.html
- 47 Gero Rueter and Katharina Wecker, "Pressure on Germany to ditch coal intensifies," DW, October 2, 2017. <http://www.dw.com/en/pressure-on-germany-to-ditch-coal-intensifies/a-40778356>
- 48 Niklas Höhne et al., "Was bedeutet das Pariser Abkommen für den Klimaschutz in Deutschland? (What does the Paris Accord Mean for Climate Action in Germany?)," NewClimate Institute, February 2016. http://www.greenpeace.de/files/publications/160222_klimaschutz_paris_studie_02_2016_fin_neu.pdf
- 49 BGR, Energy Study 2016. Reserves, Resources and Availability of Energy Resources, December 2016, p. 24. https://www.bgr.bund.de/EN/Themen/Energie/Downloads/energiestudie_2016_en.pdf?__blob=publicationFile&v=2
- 50 Stockholm Environment Institute, "Turning energy around: Coal and the German Energiewende," 2016, p. 4. <https://www.sei-international.org/mediamanager/documents/Publications/Climate/SEI-DB-2016-Energiewende-and-coal.pdf>
- 51 Clean Energy Wire, Cabinet of state of NRW approves cut-back to lignite mining plans, 6 July 2017. <https://www.cleanenergywire.org/news/german-state-cuts-back-lignite-plans-boost-citizens-energy/cabinet-state-nrw-approves-cut-back-lignite-mining-plans>
- 52 Agora Energiewende, "11 principles for a consensus on coal," January 2016, p. 9. https://www.agora-energiewende.de/fileadmin/Projekte/2015/Kohlekonsens/Agora_Kohlekonsens_KF_EN_WEB.pdf
- 53 Christian Schwägerl, "A Clash of Green and Brown: Germany Struggles to End Coal," Yale Environment 360, July 7, 2015. http://e360.yale.edu/features/a_clash_of_green_and_brown_germany_struggles_to_end_coal; Sabrina Schulz & Julian Schwartzkopf, "G7 Coal Phase Out: Germany," Oxfam, September 2015, p.16. https://www.e3g.org/docs/Germany_G7_coal_analysis_September_2015.pdf
- 54 Irene Banos Ruiz, "How far is Germany from a complete coal exit?," DW, April 3, 2017. <http://www.dw.com/en/how-far-is-germany-from-a-complete-coal-exit/a-38214847>
- 55 Julian Wettengel, Clean Energy Wire, "New owner scraps plans to expand east German lignite mine," March 31, 2017. <https://www.cleanenergywire.org/news/new-owner-scraps-plans-expand-east-german-lignite-mine>
- 56 Gerard Wynn, "Behind Vattenfall's Sell-Off of German Lignite Assets, a Subsidy Play by the Buyers: An Acquisition Spree for Regulated Fossil-Fuel Assets That Are Supported by Guaranteed Payments," Institute for Energy Economics and Financial Analysis, July 22, 2016. <http://ieefa.org/behind-vattenfalls-sell-off-german-lignite-assets-subsidy-play-buyers%E2%80%A8/>
- 57 Sivan Kartha, Tom Athanasiou and Paul Baer, "The North-South divide, equity and development - The need for trust-building for emergency mobilisation", in Development Dialogue no 61, September 2012, pp.47ff. http://www.whatnext.org/resources/Publications/Volume-III/72-dpi/vnw3_web_double_72.pdf Climate Equity Reference Project, "Fair Shares: A Civil Society Equity Review of INDCs", November 2015. https://www.oxfam.org/sites/www.oxfam.org/files/file_attachments/ib-civil-society-review-climate-indcs-191015-en_2.pdf
- 58 Climate Equity Reference Calculator, standard settings (base year 1950, \$7,500 development threshold, 50-50 responsibility-capacity balance). <https://calculator.climateequityreference.org/>
- 59 "Beschäftigte im Braunkohlenbergbau in Deutschland", 2017. <http://www.kohlenstatistik.de/19-0-Braunkohle.html>
- 60 Statistik der Kohlenwirtschaft e.V., "Belegschaft im Steinkohlenbergbau der Bundesrepublik Deutschland", 2017. <http://www.kohlenstatistik.de/18-0-Steinkohle.html>
- 61 Statistik der Kohlenwirtschaft e.V., "Beschäftigte im Braunkohlenbergbau in Deutschland", 2017. <http://www.kohlenstatistik.de/19-0-Braunkohle.html> Statistics are given for mines and power plants combined, because power plants are closely integrated with nearby captive mines, and operated by the same companies.
- 62 Statistik der Kohlenwirtschaft e.V., "Belegschaft im Steinkohlenbergbau der Bundesrepublik Deutschland", 2017. <http://www.kohlenstatistik.de/18-0-Steinkohle.html>
- 63 Bundesagentur für Arbeit (Federal Employment Agency), December 2014. <https://statistik.arbeitsagentur.de/Navigation/Statistik/Statistik-nach-Themen/Beschaeftigung/Beschaeftigung-Nav.html>, cited in Julian Schwartzkopf And Sabrina Schulz, "Structural Change in Lusatia: What Will Come After Lignite?," E3G, November 2015. https://www.e3g.org/docs/E3G_Lausitzstudie_FINAL_EN.pdf
- 64 According to IRENA, 333,700 people were employed in renewable energy in Germany in 2015. IRENA, "Renewable Energy and Jobs - Annual Review 2017", p.17. https://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Jobs_Annual_Review_2017.pdf
- 65 DGB, "German trade unions: Global climate policy for a just transition," December 1, 2015. <http://www.dgb.de/themen/++co+8740e1fe-981e-11e5-9a96-52540025ef1a>
- 66 "Taking into account the imperatives of a just transition of the workforce and the creation of decent work and quality jobs in accordance with nationally defined development priorities," UNFCCC, Adoption of the Paris Agreement, p.21. <https://unfccc.int/resource/docs/2015/cop21/eng/I09r01.pdf>
- 67 International Labour Office, Governing Body, Outcome of the Tripartite Meeting of Experts on Sustainable Development, Decent Work and Green Jobs, 325th Session, Geneva, October 5-9, 2015. http://www.ilo.org/wcmsp5/groups/public/---ed_norm/---relconf/documents/meetingdocument/wcms_420286.pdf

- 68 Ben Caldecott, Oliver Sartor & Thomas Spencer, "Lessons from previous Coal Transitions," High-Level Summary for Policy Makers, Climate Strategies / IDDR, 2017, pp. 8-10. <http://www.iddri.org/Publications/Lessons-from-previous-coal-transitions-High-level-summary-for-decision-makers>
- 69 Destatis, "Arbeitsmarkt." <https://www.destatis.de/DE/ZahlenFakten/Indikatoren/Konjunkturindikatoren/Arbeitsmarkt/arb230.html>
- 70 Statistik der Kohlenwirtschaft e.V., "Beschäftigte im Braunkohlenbergbau in Deutschland," 2017. <http://www.kohlenstatistik.de/19-0-Braunkohle.html>
- 71 Julian Schwartzkopff AND Sabrina Schulz, "Structural Change in Lusatia - What Will Come After Lignite?" E3G, November 2015, p.15. https://www.e3g.org/docs/E3G_Lausitzstudie_FINAL_EN.pdf
- 72 Isabelle de Pommereau, "In Germany's east, populist vote finds root in reunification woes," Christian Science Monitor, September 21, 2017. <https://www.csmonitor.com/World/Europe/2017/0921/In-Germany-s-east-populist-vote-finds-root-in-reunification-woes>
- 73 Emma Bryce, "Germany's Transition from Coal to Renewables Offers Lessons for the World," Scientific American, September 5, 2017. <https://www.scientificamerican.com/article/germany-rsquo-s-transition-from-coal-to-renewables-offers-lessons-for-the-world/>
- 74 Sanjeev Kumar, Arianna Americo, and Charlotte Billingham, "The New Social Contract: A Just Transition," Foundation for European Progressive Studies / Change Partnership, p.16. <http://www.changepartnership.org/wp-content/uploads/2016/09/New-social-contract-FINAL-WEB.pdf>
- 76 Anabella Rosemberg, "Strengthening Just Transition Policies in International Climate Governance," Stanley Foundation Policy Analysis Brief, April 2017, p.9. <https://www.stanleyfoundation.org/publications/pab/RosembergPABStrengtheningJustTransition417.pdf>
- 77 Emma Bryce, "Germany's Transition from Coal to Renewables Offers Lessons for the World," Scientific American, September 5, 2017. <https://www.scientificamerican.com/article/germany-rsquo-s-transition-from-coal-to-renewables-offers-lessons-for-the-world/>
- 78 Erica Peterson, "Germans Forge 'Socially Acceptable' Transition From Coal," WFPL News, December 8, 2015. <http://energyfuture.wfpl.org/germans-forge-socially-acceptable-transition-from-coal/>
- 79 Statistik der Kohlenwirtschaft e.V., "Belegschaft im Steinkohlenbergbau der Bundesrepublik Deutschland", 2017. <http://www.kohlenstatistik.de/18-0-Steinkohle.html>; and "Beschäftigte im Braunkohlenbergbau in Deutschland", 2017. <http://www.kohlenstatistik.de/19-0-Braunkohle.html> Prior to reunification, the numbers refer to West and East Germany combined.
- 80 If number of workers per tonne extracted remained constant, lignite workforce today would be 55 percent x 145,000 = 80,000.
- 81 Statistik der Kohlenwirtschaft e.V., "Belegschaft im Steinkohlenbergbau der Bundesrepublik Deutschland", 2017. <http://www.kohlenstatistik.de/18-0-Steinkohle.html>; and "Beschäftigte im Braunkohlenbergbau in Deutschland", 2017. <http://www.kohlenstatistik.de/19-0-Braunkohle.html> Prior to reunification, the numbers refer to West and East Germany combined. Post-2008, lignite employment is not disaggregated between power plants and mines; we assume mining's share of total lignite employment remains the same as in 2008 (73%).
- 82 Oliver Sartor and Andrzej Blachowicz, "End of coal: Failure to see it coming will hurt miners most," Climate Home, June 25, 2017. <http://www.climatechangenews.com/2017/06/25/just-transition-coal-possible-starts-now/>; Ben Caldecott, Oliver Sartor & Thomas Spencer, "Lessons from previous Coal Transitions," High-Level Summary for Policy Makers, Climate Strategies / IDDR, 2017, pp.8-10. <http://www.iddri.org/Publications/Lessons-from-previous-coal-transitions-High-level-summary-for-decision-makers>
- 83 Statistik Der Kohlenwirtschaft e.V., Der Kohlenbergbau in Der Energiewirtschaft Der Bundesrepublik Deutschland Im Jahre 2015, November 2016, p.49. http://www.kohlenstatistik.de/files/silberbuch_2015.pdf
- 84 "Die Zeit der fossilen Energieträger - auch der Braunkohle - geht zu Ende. Das müssen wir den Menschen offen sagen, weil wir die Verantwortung für einen gut gesteuerten Strukturwandel tragen - im Sinne der Arbeitnehmerinnen und Arbeitnehmer und der betroffenen Regionen." <https://www.bmub.bund.de/medien/regierungserklaerung-von-dr-barbara-hendricks-zu-den-klimaverhandlungen-in-paris/>
- 85 Some options for Lusatia are proposed in ulian Schwartzkopff AND Sabrina Schulz, "Structural Change in Lusatia - What Will Come After Lignite?" E3G, November 2015, p.15. https://www.e3g.org/docs/E3G_Lausitzstudie_FINAL_EN.pdf
- 86 Agora Energiewende, "Eleven Principles for a Consensus on Coal," January 2016, p. 40. https://www.agora-energiewende.de/fileadmin/Projekte/2015/Kohlekonsens/Agora_Kohlekonsens_KF_EN_WEB.pdf
- 87 European Commission, "State aid: Commission clears closure of lignite-fired power plants in Germany," May 27, 2016. http://europa.eu/rapid/press-release_IP-16-1911_en.htm
- 88 Christian Schwägerl, "A Clash of Green and Brown: Germany Struggles to End Coal," Yale Environment 360, July 7, 2015. http://e360.yale.edu/features/a_clash_of_green_and_brown_germany_struggles_to_end_coal; <http://www.airclim.org/acidnews/new-era-debate-coal-phase-out-germany>
- 89 Kerstine Appunn, "COP21 Interview: The energy transition is not a cakewalk", 07 December 2015. <https://www.cleanenergywire.org/news/cop21-interview-energy-transition-not-cakewalk>
- 90 Rystad UCube, October 2017. Total includes condensate and NGL.
- 91 Rystad UCube, October 2017. Emissions calculated using IPCC emissions factors for oil and gas (see page 18, footnote m).
- 92 Deutsche Welle, "Germany largely bans fracking with new laws," February 11, 2017. <http://www.dw.com/en/germany-largely-bans-fracking-with-new-laws/a-37510063>
- 93 Oil Change International, "Fracking," accessed October 9, 2017. <http://priceofoil.org/campaigns/extreme-fossil-fuels/no-extreme-fossil-fuels-fracking/>
- 94 Severin Carrell, "Scottish government bans fracking after public opposition," The Guardian, October 3, 2017. <https://www.theguardian.com/uk-news/2017/oct/03/scottish-government-bans-fracking-scotland-paul-wheelhouse>
- 95 Oil Change International, Shift the Subsidies database, accessed October 2017.
- 96 Climate Action Tracker, Foot off the gas: increased reliance on natural gas in the power sector risks an emissions lock-in, June 2017. http://climateactiontracker.org/assets/publications/briefing_papers/CAT-2017-06-16-DecarbonisationSeries-NaturalGas.pdf
- 97 PSE Healthy Energy, Science Summary, Climate Impact of Methane Losses from Modern Natural Gas and Petroleum Systems, November 2015. http://www.psehealthyenergy.org/data/SS_Methane_Nov2015Final.pdf
- 98 IPCC, "Climate Change 2014, Synthesis Report." http://ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf
- 99 Alexander Pfeiffer et al, "The '2°C capital stock' for electricity generation: Committed cumulative carbon emissions from the electricity generation sector and the transition to a green economy," Applied Energy, Volume 179, October 1, 2016, pages 1395-1408. <http://www.sciencedirect.com/science/article/pii/S0306261916302495>
- 100 Dave Jones et al, "Europe's declining gas demand, Trends and facts on European gas consumption," E3G, June 2015. https://www.e3g.org/docs/E3G_Trends_EU_Gas_Demand_June2015_Final_110615.pdf
- 101 Frédéric Simon, "EU power utility boss: 'Coal is finished, the hard question now is gas,'" EURACTIV.com, October 4, 2017. <http://www.euractiv.com/section/electricity/interview/eu-power-utility-boss-coal-is-finished-the-hard-question-now-is-gas/>
- 102 G20 Fossil Fuel Subsidies Sign-On Statement, June 28, 2017. <http://priceofoil.org/content/uploads/2016/06/G20-Fossil-Fuel-Subsidies-Sign-On.pdf>
- 103 Lewis, Barbara, "Pressure mounts on G20 for fossil fuel subsidies deadline," Reuters, June 28, 2016. <https://www.reuters.com/article/us-g20-finance-energy-subsidies/pressure-mounts-on-g20-for-fossil-fuel-subsidies-deadline-idUSKCN0ZE1X1>
- 104 Reuters, "G20 urged to ditch fossil fuel subsidies by 2020, go green," February 14, 2017. <http://in.reuters.com/article/us-climate-change-subsidies-g20/g20-urged-to-ditch-fossil-fuel-subsidies-by-2020-go-green-idINKBN15U00Y>
- 105 V20 Ministerial Communiqué, "Ministerial Dialogue IV of the Vulnerable Twenty (V20)," Washington, DC, April 23, 2017. http://www.v-20.org/wp-content/uploads/2017/04/V20-Communique-Spring-2017_FINAL.pdf
- 106 KfW, "High eligibility standards for KfW's financings of coal-fired power plants," January 2017. <https://www.kfw.de/KfW-Group/Newsroom/Press-Material/Themen-kompakt/Kohlekraftfinanzierung/>
- 107 Clean Energy Wire, "No funding of fossil fuel projects," December 2, 2016. <https://www.cleanenergywire.org/news/germany-ends-coal-funding-wb-gabriel-defends-renewables-support/no-funding-fossil-fuel-projects>
- 108 IJ Global, "FPSO Turritella," July 9, 2016. <https://ijglobal.com/data/transaction/35295/fpso-turritella>
- 109 Offshore Energy Today, "Shell buys FPSO Turritella for \$1 billion," July 12, 2017. <http://www.offshoreenergytoday.com/shell-buys-fpso-turritella/>
- 110 SBM Offshore, "FPSO Turritella: Floating Production Storage and Offloading," April 2016. <http://www.sbmoffshore.com/wp-content/uploads/2016/05/FACTSHEET-TURRITELLA.pdf>
- 111 Ibid.
- 112 Ibid.
- 113 Rystad UCube, October 2017.
- 114 Article 4, United Nations, Paris Agreement, 2015. https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf
- 115 See: "Federal Government report on the financing of international coal-related projects for the Economic Committee of the Bundestag," December 22, 2014. https://www.bmwi.de/Redaktion/DE/Downloads/B/bericht-der-bundesregierung-zur-internationalen-kohlefinanzierung-fuer-den-wirtschaftsausschuss-des-deutschen-bundestages-englisch.pdf?__blob=publicationFile&v=3
- 116 KfW Group, "Guidelines on the financing of coal-fired power plants," March 17, 2015. https://www.kfw.de/nachhaltigkeit/PDF/Nachhaltigkeit/KfW-Guidelines_Coal_Financing_2015-03-17_EN.pdf
- 117 OECD, "OECD Arrangement on Officially Supported Export Credits," February 2016. [http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?docId=nguage=en&cote=tad/pg\(2016\)1](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?docId=nguage=en&cote=tad/pg(2016)1)
- 118 This finance was excluded from OCI's Shift the Subsidies database given the lack of information on project-level transactions. Export Credit Guarantees of the Federal Republic of Germany: Hermes Cover, "Annual Report 2016," 2016, p. 34. https://www.agaportal.de/_Resources/Persistent/7b5ec85081238194a3276cb707b9e18f4fb3782/JB_2016_EH_E_F.pdf
- 119 Gerasimchuk, I. and Bassi, A. "Unlocking Supply and Locking in Carbon: The paradox of determining which fossil fuel subsidies are the worst for the climate," IISD Global Subsidies Initiative, 2016. <https://static1.squarespace.com/static/56fb6e97da24f416c2f651f/t/57e8846ce6f2e191cbef4c3/1474856227403/FFS-Conf-2016-Gerasimchuk-Bassi-Unlocking-supply.pdf>
- 120 "Annual Report 2016: Export Credit Guarantees of the Federal Republic of Germany," Hermes Cover, 2016, p.50. https://www.agaportal.de/_Resources/Persistent/7b5ec85081238194a3276cb707b9e18f4fb3782/JB_2016_EH_E_F.pdf
- 121 "Annual Report 2016: Export Credit Guarantees of the Federal Republic of Germany," Hermes Cover, 2016, p.15. https://www.agaportal.de/_Resources/Persistent/7b5ec85081238194a3276cb707b9e18f4fb3782/JB_2016_EH_E_F.pdf
- 122 Lunden, L. and Fjaertoft, D., "Government Support to Upstream Oil & Gas in Russia How Subsidies Influence the Yamal LNG and Prirazlomnoye Projects," International Institute for Sustainable Development, 2014. https://www.iisd.org/gsi/sites/default/files/ffs_aws_russia_yamalpirazlomnoye_en.pdf
- 123 Bodnar, P., Ott, C., Thwaites, J., De Marez, L., and Kretschmer, B., "Net Climate Finance: Reconciling The Clean And Dirty Sides Of The Finance Ledger," Rocky Mountain Institute, 2017. https://d231jw5ce53gca.cloudfront.net/wp-content/uploads/2017/07/RMI_Net_Climate_Finance_Discussion_Paper_2017-1.pdf
- 124 Excludes finance targeted at a regional level. Climate finance from dedicated multilateral climate funds, Climate Funds Update: <http://www.climatefundsupdate.org/>
- 125 OECD, "Climate and Disaster Resilience Financing in Small Island Developing States," 2016. http://www.oecd-ilibrary.org/development/climate-and-disaster-resilience-financing-in-small-island-developing-states_9789264266919-en
- 126 Charlene Watson, et al, Overseas Development Institute, "Climate finance briefing: small island developing states," November 2016. <https://www.odi.org/sites/odi.org.uk/files/resource-documents/11053.pdf>

