IISD REPORT FOR SDC

Unburnable Carbon:

Getting the signals right for investors in low- and lower-middle-income countries

June 2018

IISD
International Institute for Sustainable Development

Abbreviations

AFD	Agence Française de Développement
AfDB	African Development Bank
ADB	Asian Development Bank
CCS	carbon capture and storage
CO_2	carbon dioxide
DISCOM	distribution company (India)
DFID	UK Department for International Development
EBRD	European Bank for Reconstruction and Development
EIB	European Investment Bank
EITI	Extractive Industries Transparency Initiative
ETS	emissions trading scheme
EU	European Union
FFSR	Fossil Fuel Subsidy Reform
GCF	Green Climate Fund
GDP	gross domestic product
GHG	greenhouse gases
GNI	gross national income
Gt	gigatonne
IADB	Inter-American Development Bank
IEA	International Energy Agency
IEEFA	Institute for Energy Economics and Financial Analysis
IRENA	International Renewable Energy Agency
IFI	international financial institutions
IGO	intergovernmental origination
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IISD	International Institute for Sustainable Development
ISA	International Solar Alliance
KING	Keep-it-in-the-ground
LIC	low-income country
LNG	liquefied natural gas
LMIC	lower-middle income country
MoU	Memorandum of Understanding
Mt	megatonne
NDC	Nationally Determined Contribution
NGO	non-governmental organization
NPA	non-performing asset
OPEC	Organization of Petroleum Exporting Countries
PPA	power purchase agreement
PPCA	Powering Past Coal Alliance
RPJMN	Rencana Pembangunan Jangka Menengah Nasional, Indonesia's National Medium-Term Development Plan for the period 2015-2019
SDC	Swiss Development Cooperation
SDG	Sustainable Development Goals
SECO	State Secretariat for Economic Affairs, Switzerland
SOE	state-owned enterprise
SBSTA	Subsidiary Body for Scientific and Technological Advice
TERI	The Energy and Resources Institute
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States dollar
WRI	World Resources Institute

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- Two anonymous interviewees
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- Russell Bishop, Principal Economist, Economics, Policy and Governance group, EBRD
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Executive Summary

If the commitments under the Paris Agreement on climate change are to be kept, more than two-thirds of the already-proven fossil fuel reserves will become unburnable carbon and must be left in the ground. Yet there is a large gap between this evidence in the context of the Paris Agreement and existing policies as signals that guide investors and donors around the world, including in Switzerland.

On the one hand, the plummeting costs of renewables and carbon pricing start making fossil fuels less competitive. Therefore, both developed and developing countries with fossil fuel exports anticipate competition for the opportunity to supply the last barrel of oil, cubic metre of natural gas and tonne of coal. This trend is particularly evident in the coal market, which stagnated in 2014–2016.

On the other hand, wishful fossil fuel market forecasts, "all-of-the-above" energy strategies as well as hundreds of billions of USD in public finance, subsidies and, in certain cases, development aid still support fossil fuel extraction and coal power. All these signals lock in investments in carbon-intensive infrastructure for the next decades. However, most of the new fossil fuel projects are incompatible with the 1.5 and 2 degrees climate targets and are likely to have shorter-than-expected lifetimes, leading to asset stranding. The International Renewable Energy Agency estimated the associated investment losses at up to USD 7 trillion for fossil-fuel-extracting assets and USD 1.9 trillion for fossil-fuel-based power generation on the global level.

Low-income countries (LICs) and lower-middle-income countries (LMICs) with significant fossil fuel assets stand to lose the most in asset stranding and impacts on their development. With less diversified economies and trade, they are more vulnerable to the vagaries of global energy markets. Both a literature review and our interviews with 27 stakeholders from different backgrounds testify to the increasing concerns about asset stranding in LICs and LMICs (see Annex 1 for the questionnaire underlying these semi-structured interviews). This report uses case studies of three LMICs with the largest remaining fossil fuel reserves (India, Indonesia and Ukraine) to illustrate the emerging challenges of unburnable carbon for development.

We find that the unfolding narratives on unburnable carbon are polarized, varying from deliberately negative ("stranded assets," "carbon bubble," "keep-it-in-the-ground") to more positive ("beyond fossil fuels," "just transition"). However, in LICs and LMICs, practical conversations regarding a just transition away from fossil fuels in these countries might best be framed in terms of national goals for sustainable economic diversification.

The ultimate question for LICs and LMICs is whether they view their fossil fuel reserves as a cash cow for exports or as strategic resources for supplying domestic energy to boost economic development. In the former case, economic diversification should support either alternative export-oriented activities, or replacement of imports. In contrast, if domestic fossil fuels are viewed as a resource for development, their combustion will ultimately conflict with the concerns about health impacts and air quality standards as well as climate commitments under nationally determined contributions (NDCs) to the Paris Agreement.

In the international arena, a growing number of actors recognize the mismatch between the ambitious goals of the Paris Agreement and resource-rich countries' development trajectories. Belize, Costa Rica, France, Ireland and New Zealand have all taken measures to curb oil and gas production, and 30 governments have launched the Powering Past Coal Alliance (PPCA) to phase out traditional coal power.

Such first-mover initiatives cover only a fraction of global fossil fuel supply. However, first movers see their restrictions on fossil fuel supply as a sign of climate action integrity and a signal to investors around the world. Thereby these countries address Article 2c of the Paris Agreement on "making finance flows consistent with a pathway toward low greenhouse gas emissions and climate-resilient development."

With no fossil fuel production or coal power, Switzerland potentially falls in the same category. Switzerland's possible engagement on unburnable carbon and stranded assets should play to its strengths as a country whose opinion matters for international finance, investments and smarter development policies. the country has already embraced some of this agenda, e.g., through its participation in the Friends of Fossil Fuel Subsidy Reform (FFSR) and the PPCA. But it can do more. The first two recommendations below are Switzerland-specific, the other two apply to all countries.

1. **Help shift financial flows away from fossil fuels.** Given its reputation as the world's predominant financial hub, the most significant contribution on the unburnable carbon agenda would be getting the signals right for Swiss and international investors, in both the public and private sectors. Switzerland should ensure that its own public finance institutions such as the Swiss National Bank and SERV use carbon-screening tools and shift finance away from fossil fuels. Switzerland should also use its voice in multilateral development banks, the Global Environment Facility and the Green Climate Fund to influence both institution-wide decisions and specific projects.

2. **Help develop a positive narrative on energy transition**. Switzerland's opinion matters when it comes to investment decisions. There is a role for Switzerland to support the narrative on the transition away from fossil fuels as financially savvy and innovative. Switzerland is also seen as a country that has neither a post-colonial nor a "new colonial" agenda. In this capacity and without being patronizing, Switzerland can help create a positive decarbonization agenda that frames the clean energy transition as an opportunity for development rather than "carbon imperialism."

3. **Ensure policy coherence**. Coherence between climate action and other policies needs to be ensured among different agencies of the Swiss government, within intergovernmental organizations and international financial institutions (IFIs), and within different government agencies of aid-recipient countries. Within Switzerland, the policy coherence agenda can reference its international commitments such as the Paris Agreement or membership in first-mover alliances such as PPCA. PPCA's commitment on coal finance, for instance, means that Switzerland has undertaken not to provide through its public finance institutions loans or loan guarantees to traditional coal power plants.

From the aid recipients' perspective, there is an increase in requests to donors for technical assistance and financial products that can help them deliver NDCs. This can be used as an opportunity to align NDCs and long-term energy strategies of developing countries with evidence-based scenarios of energy markets developments.

4. Support economic diversification for a just transition. The energy transition needs to provide viable alternatives to workers, communities and countries that heavily depend on fossil fuels. The earlier and better the needs of a just transition are anticipated, the less disruptive the change will be for vulnerable groups. There is a growing body of best practices in this respect, including the lessons learned from coal phase-outs and transitions in other sectors, e.g., the nuclear phase-out in Switzerland.

Diversification often means the implementation of measures that lead to climate change mitigation and clean production. A lot of development aid that Switzerland provides already promotes economic diversification, such as the country's support to clean tech.

There are more avenues for economic diversification. Of particular relevance are all solutions that can help bring down the costs of integrating renewable energy into existing energy market systems as well as managing electricity grids with significant trading across borders. Equally important are financial innovation for financial security mechanisms in the energy sector and the development of bankable green projects and green non-financial products suitable for investors. The International Solar Alliance (ISA) and the group of finance ministers from climate vulnerable countries (V20) are examples of LIC- and LMIC-driven platforms that target this agenda. Switzerland can productively engage with both the ISA and V20. Switzerland can also work with the Clean Energy Ministerial where energy investment and finance activities, promoted by the Nordic members, can be of particular relevance to Switzerland.

The agenda regarding unburnable carbon outlined in this report requires large-scale, ambitious action, However, in the context of Swiss Development Cooperation, its implementation can be launched with several initial steps:

- An internal review and discussion within SDC
- A briefing for other federal agencies, including SECO, BAFU and other bodies
- A knowledge event in Bern or Geneva open to civil servants and broader public (possibly under the Traverse format)
- An international workshop with countries and IFIs that are first movers on limiting fossil fuel supply and power (possibly in cooperation with Chatham House)
- Policy briefs and other communication materials such as op-eds and articles in English, German and French. For LICs and LMICs, these materials can be also made country-specific.

IISD has both capacity and interest in supporting SDC in delivering these proposed steps.

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Introduction

If the commitments under the Paris Agreement on climate change are to be kept, more than two-thirds of already-proven fossil fuel reserves will become unburnable carbon and must be left in the ground (Table 2.2., page 64 in Intergovernmental Panel on Climate Change 2014).[1]

Yet there is a large gap between this evidence in the context of the Paris Agreement and the existing policies as signals that guide investors and donors around the world, including in Switzerland. This gap has brought about polarized and heated discussions about the future of oil, gas and coal projects in both developed and developing countries and led to what is perhaps one of the most dynamically developing policy innovations in the aftermath of the Paris Agreement.

This report explores the ways to navigate and close this gap with a focus on a just transition for low-income countries (LICs) and lower-middle-income countries (LMICs) in line with the Paris Agreement and the Sustainable Development Goals (SDGs). The analysis includes policies affecting investments along the fossil fuel supply value chain from exploration and field development to transportation and fossil fuel power. The scope is global, with India, Indonesia and Ukraine being national-level case studies due to these LMICs' significant coal resources.

The report draws on the review of the latest policy discussions on unburnable carbon and Article 2c of the Paris Agreement on "making finance flows consistent with a pathway toward low greenhouse gas emissions and climate-resilient development" (UNFCCC, 2015). This review included the analysis of policy documents of international financial institutions (IFIs), intergovernmental organizations (IGOs), relevant government agencies of both developed and developing countries, as well as the growing body of literature on unburnable carbon from academia and non-governmental organizations (NGOs). The authors have also conducted interviews with 27 representatives of relevant stakeholder groups both internationally and in case-study countries (see the Acknowledgements section for details).

Chapter 1 lays out the state of play on unburnable carbon and the emerging first movers on phasing out fossil fuel supply and a just transition. Chapter 2 examines the situation in LICs and LMICs and their needs for a just transition away from fossil fuels. Chapter 3 concludes with recommendations for Switzerland on how to get the signals right for investors and development assistance and to avoid the stranding of assets, workers and communities in the face of the sea change in climate and energy policies.

The paper has been prepared by the International Institute for Sustainable Development for internal use by the Swiss Development Cooperation (SDC).

[1] Barring unexpected advances in carbon capture and storage (CCS).

Chapter 1. Unburnable Carbon: Recognizing the endpoint of climate policies

This chapter takes stock of the facts and fast-changing narrative on carbon budgets, unburnable carbon, fossil fuel supply and related infrastructure. It also details the emerging first movers on phasing out fossil fuel supply and a just transition.

1.1. Climate Science and Unburnable Carbon

Depending on the assumptions, the remaining carbon budget is estimated between 400 and 850 Gt of carbon dioxide (CO_2) equivalent (McGlade & Elkins, 2015; Verkuijl et al., 2018; Rogelj et al., 2015) while annual greenhouse gas (GHG) emissions amount to roughly 35 to 40 gigatonnes (Gt) at present (Le Quéré et al. 2016).

Thus the window for making the right investment choices is closing as fast as the global carbon budget. The investments made today lock in for decades either a climate-smart, inclusive growth pathway, or a high-carbon, inefficient and unsustainable future (New Climate Economy, 2016). In other words, most of today's investments in new fossil fuel infrastructure such as exploration and development of new fossil fuel reserves as well as the construction of pipelines, liquefied natural gas (LNG) terminals and coal power plants take us to a global temperature rise beyond the Paris Agreement's goals. One recent report found that 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°C (Muttitt et al., 2016).

The risk of the carbon lock-in is well understood by vulnerable low- and lower-middle-income countries. In their vision, environment ministers of 48 climate vulnerable countries stated: "We strive to eliminate high-carbon investments and harmful subsidies, including through enhancing enabling environments both at the international and national levels so as to decarbonize the global economy rapidly" (Climate Vulnerable Forum, 2016).

Furthermore, there is also a need for sunsetting of existing high-carbon infrastructure. This process has already started with coal phase-outs but needs to extend to oil and gas phase-outs and incorporate the best practices of a just transition for workers, communities and countries (Gerasimchuk et al., 2018; Rosemberg, 2017).

This is a significant challenge. First, the Paris Agreement does not even mention fossil fuels. Further, there are five relevant, but different SDGs that are still being reinterpreted and reconciled with each other (#7 on Affordable and Clean Energy, #8 on Decent Work & Economic Growth, #9 on Industry, Innovation & Infrastructure, #12 on Responsible Consumption & Production and #13 on Climate Action). In the context of climate action and sustainable development, however, policy discussions have historically focused on managing demand rather than managing supply (see Text Box 1). Second, the obvious, but often avoided question is whose unburnable carbon it is, and which countries will be extracting the last barrel of oil, cubic metre of gas, or tonne of coal (see Text Box 2).

This report takes a hands-on approach to both the issue of phasing out fossil fuels and that of carbon budget distribution among developed and developing fossil fuel producers. In both cases, we notice the fast-changing narratives and summarize how countries and institutions react to these narratives in the context of on-the-ground developments.

Text Box 1. Cutting Emissions With "Both Arms of the Scissors"

To best mitigate climate change, we need both supply-side policies (such as the removal of fossil fuel production subsidies, moratoria and "no-go zones" or coal phase-out) and demand-side policies (such as carbon pricing, removal of fossil fuel consumption subsidies, or fuel and energy efficiency standards). The climate challenge is so urgent that we need all tools available. As with government attempts to fight other threats, such as illegal arms, action is required along the entire chain, from production to consumption.

Since the inception of the international climate regime under the UNFCCC, policy-makers have focused mainly on demand-side policies, yet this has not been enough to divert the world from a trajectory toward dangerous climate change. The political economy is also very different for the two sets of policies: demand-side management often requires policies that need to be accepted by a large number of actors, while on the supply side there are fewer key players in each country. In this case, executive decisions like coal phase-out or "no-go zones" can sometimes be more acceptable. For an overview of the strengths and

challenges of different supply-side policies, see Lazarus, Erickson, & Tempest (2015).

Combining supply-side climate policies—like the removal of subsidies to fossil fuel production—and demand-side climate policies that reduce consumption can be a more efficient and cost-effective way of getting to net zero emissions than using either approach alone. Green & Denniss (2018) use the metaphor of cutting emissions "with both arms of the scissors" to explain this two-pronged approach to climate change mitigation. A 2013 analysis by Statistics Norway also illustrates this point, indicating that, in Norway's case, combining supply and demand-side climate policy could deliver global emissions reductions at one-third the cost of using demand-side measures alone (Fæhn, Hagem, Lindholt, Mæland, & Rosendahl, 2013).

Text Box 2. Whose Unburnable Carbon Is It?

A letter by McGlade & Elkins (2015) published in *Nature* took the most straightforward approach to modelling the geographical distribution of fossil fuels unused when limiting global warming to 2°C. McGlade & Elkins looked at the costs of extraction under two scenarios: with and without carbon capture and storage (CCS). In both cases, unburnable carbon limitations affect first of all coal-rich countries such as USA, China, India, the former Soviet Union and Australia. As for oil and gas, they are unburnable for high-cost extractive projects such as in the Arctic and bitumen sands in Canada (see Table 1).

Table 1 | Regional distribution of reserves unburnable before 2050 for the 2 °C scenarios with and without CCS

	2 °C with CCS						2 °C without CCS					
	Oil		Gas		Coal		Oil		Gas		Coal	
Country or region	Billions of barrels	%	Trillions of cubic metres	%	Gt	%	Billions of barrels	%	Trillions of cubic metres	%	Gt	%
Africa	23	21%	4.4	33%	28	85%	28	26%	4.4	34%	30	90%
Canada	39	74%	0.3	24%	5.0	75%	40	75%	0.3	24%	5.4	82%
China and India	9	25%	2.9	63%	180	66%	9	25%	2.5	53%	207	77%
FSU	27	18%	31	50%	203	94%	28	19%	36	59%	209	97%
CSA	58	39%	4.8	53%	8	51%	63	42%	5.0	56%	11	73%
Europe	5.0	20%	0.6	11%	65	78%	5.3	21%	0.3	6%	74	89%
Middle East	263	38%	46	61%	3.4	99%	264	38%	47	61%	3.4	99%
OECD Pacific	2.1	37%	2.2	56%	83	93%	2.7	46%	2.0	51%	85	95%
ODA	2.0	9%	2.2	24%	10	34%	2.8	12%	2.1	22%	17	60%
United States of America	2.8	6%	0.3	4%	235	92%	4.6	9%	0.5	6%	245	95%
Global	431	33%	95	49%	819	82%	449	35%	100	52%	887	88%

FSU, the former Soviet Union countries; CSA, Central and South America; ODA, Other developing Asian countries; OECD, the Organisation for Economic Co-operation and Development. A barrel of oil is 0.159 m^3; %, Reserves unburnable before 2050 as a percentage of current reserves.

Source: McGlade & Elkins (2015).

While the cost-based approach makes economic sense, it is based on the geographical lottery of resource endowment and does not consider the implications for equity and development. On the one hand, many countries, especially in the developing world, consider exploitation of their fossil fuel reserves to be their sovereign right to development (Kartha et al., 2016; Kartha et al., 2018). For instance, this is certainly true for many African countries that have recently discovered oil and gas deposits and place high hopes on their development (Gueye, 2018).

On the other hand, there are more and more voices, especially in the developed world, pointing at the inconsistency of the continued fossil fuel extraction in the OECD countries with their Paris Agreement Commitment. In particular, the Lofoten Declaration, signed by nearly 500 NGOs from both developed and developing countries, calls on “countries, regions, and corporate actors who are best positioned in terms of wealth and capacity to undergo an ambitious just transition away from fossil fuel production.” The Declaration specifies that in terms of foregoing fossil fuel extraction, “leadership must come from countries that are high-income, have benefited from fossil fuel extraction, and that are historically responsible for significant emissions” (The Lofoten Declaration, 2017).

Annex 2 provides a summary table on different scenarios of carbon budget allocation among developed and developing countries.

In the meantime, some researchers have also observed the so called “green paradox.” The “green paradox” can emerge when policies aimed at curbing fossil fuel supply and demand act like an announced expropriation for the owners of fossil fuel resources, encouraging them to accelerate resource extraction and hence to accelerate global warming (Sinn, 2008). An illustration of this phenomenon is a statement from Décio Oddone, Director of Brazil’s National Petroleum Agency that has been aggressively promoting oil exploration and production: “When the oil age ends, there will still be a lot of oil in the ground. Hopefully it won't be ours“ (Lima, 2017). However, research by Bauer et al. (2018) found that, for a wide range of future climate policies, anticipation effects, on balance, reduce CO_2 emissions. For example, strong divestment from coal power plants started 10 years ahead of the implementation of policies restricting coal power. Overall, divestment from fossil fuels has prevalence over the “green paradox.”

In summary, both the academic and policy discussions on the distribution of burnable and unburnable carbon among countries are polarized. These discussions are unlikely to be resolved on the tight timeline required for climate action and keeping climate change in line with the Paris Agreement goals.

In 2016, global expenditure in the oil and gas sector totalled USD 649 billion. That was more than double the USD 297 billion invested in renewable electricity generation (International Energy Agency, 2017). As these numbers suggest, institutional inertia and entrenched industry interests continue to stand in the way of shifting investment into sustainable energy.

1.2. Positive and Negative Narratives

The gap between the very straightforward climate science on unburnable carbon and current investors' behaviour has led to a plethora of terms that climate-aware stakeholders use to describe this same phenomenon. Table 2 summarizes some of these terms used, depending on the framework. It is worth noting that definitions for each of the terms are still being settled.

Table 2. Terms Used to Communicate "Unburnable Carbon" to Different Audiences Under the Moral and Risk Frameworks

Moral framework = normative: we should stay within the carbon budget to avoid climate change beyond 1.5 or 2 C° *Mostly used in the climate community*	**Risk framework = fossil fuels are increasingly risky investments, yet jobs and economies depend on them** *Mostly used in the investor community and among mainstream policy-makers*
Deliberately negative & creating a sense of urgency: "unburnable carbon," "carbon budget, "Keep-it-in-the-ground" (KING) campaigns	**Deliberately negative & creating a sense of urgency:** "stranded assets," "stressed assets," "carbon bubble"
Deliberately neutral: "supply-side mitigation," "fossil fuel phase-out," "managed decline" as a better alternative to "unmanaged decline"	**Deliberately neutral: "**energy transition," "responsible investment"
Trying to be positive: "Fossil-Free," "Beyond Coal," "Powering Past Coal"	**Trying to be positive:** "just transition," "no one left behind," "economic diversification"

Source: Authors' summary.

First, there is a moral framework that takes climate science as a point of departure and is therefore more used in the climate community. Terms such as "carbon budget," "unburnable carbon," "supply-side mitigation" and "keep-it-in-the-ground" campaigns are perhaps the most well known in this category.

Second, there is a risk framework that is used mostly in the investor community. Among these terms, "stranded assets" is perhaps the most widely used, creating urgency for divestment from fossil fuels (Carbon Tracker Initiative, 2017). The risk framework also extends to broader risk implications for those workers, communities and the entire economies who significantly depend on fossil fuel supply at present. At the level of countries, just the titles of two recent publications illustrate the risk framework application: "Stranded Nations" (Manley, Cust, & Cecchinato, 2017) and "From Riches to Rags?" (Schlösser et al., 2017).

Obviously, the use of different frameworks and terms may produce very different reactions and should be nuanced for different audiences. In certain countries, an aggressive pro-climate agenda can be counterproductive in being seen as anti-development and even, in the terminology of some Indian commentators, as "carbon imperialism" (Prasad, 2017).

In this report, we are using several of these terms depending on the context, but have chosen the term "unburnable carbon" as the leading concept since this analysis departs from the imperatives of the Paris Agreement and climate science.

With both moral and risk frameworks, there is also a recognition of the need for a positive agenda in addition to the predominantly negative conversation about the "unburnable wealth of nations." That is one of the reasons why "a just transition" and concepts like "beyond fossil fuels" are increasingly important, as we will discuss in Chapters 2 and 3.

1.3. First Movers on Restricting Fossil Fuel Supply

The international climate action community has long recognized "common, but differentiated responsibility" and the need for different countries to implement the climate change mitigation agenda at different speeds and through different funding mechanisms. This approach has been reflected in the bottom-up voluntary process of different countries' commitments to climate action under their intended Nationally Determined Contributions (NDCs) in the lead-up to the Paris Agreement.

This "different speeds" approach also continues to unfold in the aftermath of the Paris Agreement. Therefore it is not surprising to see, in the face of the alarming emissions trajectory and under the agenda of "enhancing ambition," the emergence of numerous multilateral voluntary initiatives, coalitions and other "first-movers' clubs."

For example, Switzerland has already been a member of one such volunteer group, the Friends of Fossil Fuel Subsidy Reform, since its establishment in 2010 (Friends of Fossil Fuel Subsidy Reform, n.d.). Switzerland also led the Friends' submission on fossil fuel subsidies to the Talanoa Dialogue, a consultation process launched in the margins of the UNFCCC and open to both UNFCCC Parties and observers.

In November 2017, Switzerland joined another "first-movers' club," the "Powering Past Coal Alliance" (PPCA), led jointly by the United Kingdom and Canada. As of May 2018, the PPCA unites over 30 national and subnational governments as well as some companies whose ambition is "to accelerate clean growth and climate protection through the phase-out of … existing traditional coal power" and to place "a moratorium on any new traditional coal power stations without operational CCS." Further, all PPCA members "commit to supporting clean power through their policies (whether public or corporate, as appropriate) and investments and restricting financing for traditional coal power stations without operational CCS" (Environment Canada, n.d.).[2]

The idea of an alliance of first movers on restricting oil and gas supply and use is also being floated. In the past, countries also used various policies restricting fossil fuel supply (see Text Box 3). But countries have only recently started linking some of these policies with climate action.

[2] In response to the PPCA, several statements from the Trump Administration indicated that the United States is considering forming a "Clean and Advanced Fossil Fuel Alliance" to advocate for natural gas and coal technology and exports (Colman, 2018). The United States, Canada, the United Kingdom and Japan also launched a coalition to promote nuclear energy, called "Nuclear Innovation: Clean Energy (NICE)" (Mathiesen, 2018).

Text Box 3. Examples of Policies Limiting Fossil Fuel Supply

Policies that restrict fossil fuel supply include such measures as:

- Production taxes
- Removal of fossil fuel production subsidies
- Removal of public finance for fossil fuel infrastructure
- Moratoriums and bans on fossil fuel infrastructure and exploration and development of oil, gas and coal
- Moratoriums and bans on fossil fuel power
- Production and export quotas
- Other restrictions on fossil fuel trade

Production taxes are perhaps the most widespread policy for managing fossil fuel supply, though the taxation of oil, gas and coal extraction is governed by the logic of capturing natural resource rents rather than climate considerations. Moreover, during periods of low oil prices, governments tend to provide tax breaks—i.e., subsidies—to fossil fuel production (Gerasimchuk et al., 2017). However, in India, a coal cess (a form of tax) was used to partially fund the transition to clean energy (Garg, 2016).

Well-known examples of supply-side policies are production quotas within the Organization of Petroleum Exporting Countries and bans on exports of oil and gas in the United States (lifted in 2015). Another common supply-side policy is restricting coal production licences, driven by both coal oversupply and local air pollution problems. There are numerous examples of decisions to consolidate or shut down coal mines in Europe and China, including very recently (Bridle et al, 2017, Gerasimchuk et al., 2018).

Motivated by the need to protect water and biodiversity, several national and subnational jurisdictions also implement moratoriums or bans on hydraulic fracturing (fracking) (e.g., Quebec, several states in the United States) and oil and gas exploration and production offshore (e.g., Belize, Lofoten islands in Norway) (Verkuijl et al. 2018).

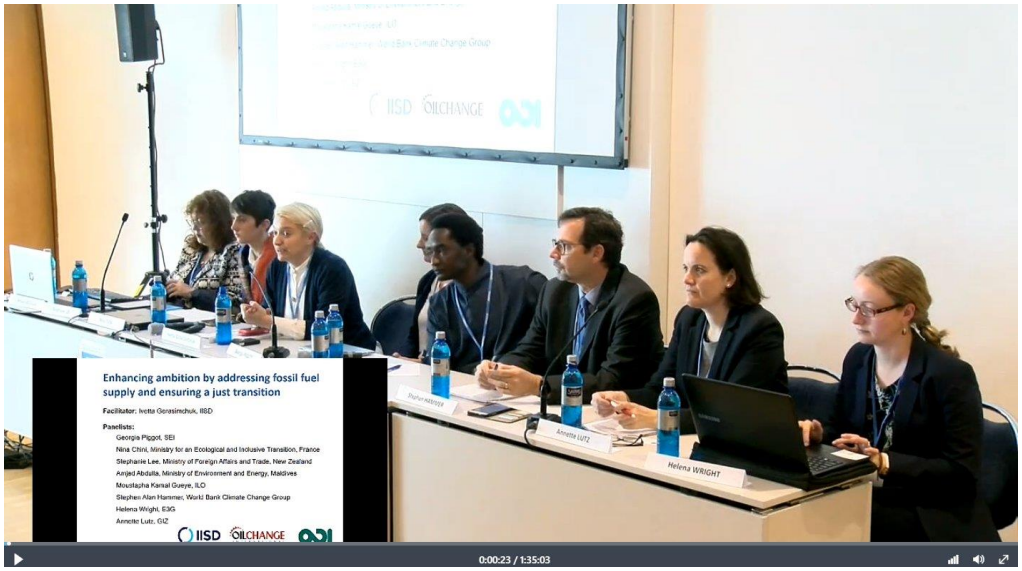
A famous—but failed—attempt of an ambitious supply-side policy came in the form of the Yasuni ITT Initiative in Ecuador. In 2007, Ecuador announced that it would forego the development of a billion barrels of oil (400 Mt of CO_2) in a national park, extremely important not just for biodiversity, but also for the indigenous people and cultural heritage of Ecuador. The initial proposal sought funding equivalent to half of the potential oil reserve earnings, as a form of payment for the preserved ecosystem services, including the climate benefits (Lazarus et al., 2015). The funding was sought from the global donor community with a view to establishing an internationally administered trust fund that would have provided a revenue stream to finance sustainable development, conservation and social development programs. However, Ecuador managed to secure only a fraction of the requested funding, and in September 2013 the Yasuni ITT Initiative was abandoned. A Chinese company was granted a licence to develop the oil reserves (Sovacool & Scarpaci, 2016).

In December 2017, France became the first country in the world to permanently ban new oil exploration licences with immediate effect and all oil extraction by 2040 (The Independent, 2017). Also in December 2017, the World Bank announced its plan to stop funding upstream oil and gas after 2019, joining other private and public financial institutions divesting from fossil fuels (World Bank, 2017). In April 2018, New Zealand announced an end to oil and gas exploration in its waters, while Ireland is close to passing similar legislation (Young, 2018; Finn, 2018). In May 2018, Costa Rica's newly elected President raised the bar even higher by announcing a plan to permanently ban fossil fuels and to make Costa Rica the first fully decarbonized country in the world (The Independent, 2018). Innovatively, in all these instances countries referred to the need for urgent climate action in the rationale for these new policies limiting fossil fuel supply.

A good snapshot of what is to come next is the Talanoa Dialogue for Climate Ambition, a consultation process launched in the margins of the UNFCCC and open to both UNFCCC Parties and observers. In their closing statement at the 23rd Conference of the Parties of the UNFCCC in 2017, the world's 47 least developed countries requested that the Talanoa Dialogue include "managing a phase-out of fossil fuels" (Republic of Ethiopia, 2017). And indeed, a summary of submissions to the Talanoa Dialogue prepared by the UNFCCC Secretariat in April 2018 included the calls for both supply-side action and a just transition (UNFCCC, 2018b).

In the spirit of the Talanoa Dialogue, the International Institute for Sustainable Development, in cooperation with several other observers, organized an official side-event on "Enhancing ambition by addressing fossil fuel supply and ensuring a just transition" during the May 2018 round of climate negotiations in Bonn (online recording available, see UNFCCC, 2018a). For the first time, representatives of UNFCCC Parties (France, New Zealand and the Maldives) joined observers in a public discussion of supply-side mitigation (see photos). One idea that came out of this discussion was the concept of an international alliance of first movers on limiting fossil fuel supply, similar to other international groups raising the climate action bar, such as the Friends of Fossil Fuel Subsidy Reform and the Powering Past Coal Alliance (UNFCCC, 2018a).

First-mover initiatives are voluntary, and the countries committing to them unilaterally or multilaterally have so far accounted for only a fraction of global production of fossil fuels and coal power. However, first movers see their policies restricting fossil fuel production as a sign of climate action integrity and a signal to investors. Thereby these countries address Article 2c of the Paris Agreement on "making finance flows consistent with a pathway toward low greenhouse gas emissions and climate-resilient development.



IISD-OCI-ODI official side-event at SBSTA 48 of UNFCCC on "Enhancing "Enhancing ambition by addressing fossil fuel supply and ensuring a just transition." Bonn, May 5, 2018.

CHAPTER 2. Avoiding Stranded Assets: Key Issues for Low-Income Countries and Lower-Middle-Income Countries

The chapter explains the concept of asset stranding in the climate context and introduces mappings of countries likely to be affected by the transition away from fossil fuels. Drawing on interviews with stakeholders, the chapter discusses the key issues of asset stranding and economic diversification away from fossil fuels for LICs and LMICs in both net energy importer and net energy exporter categories. The chapter also reviews other international donors' reactions to the unburnable carbon agenda.

2.1. Mapping the Stranding of Fossil Fuel Assets

In the strict sense, stranded assets are assets that lose value, or generate new liabilities, before they reach the end of their planned economic life (Caldecott, Howarth & McSharry, 2013; Carbon Tracker, 2017; International Renewable Energy Agency, 2017; Schlösser et al., 2017).

However, sometimes the term "stranding" is applied more broadly—not just to investors' assets but also to fossil fuel reserves, jobs and even countries (Manley et al. 2017) to indicate their exposure to economic stress. In some countries such as India, the terms "stranded assets," "non-performing assets" (NPAs) and "stressed assets" are generally used interchangeably. With respect to fossil fuels, the term "stranded assets" was coined initially to motivate private investors to divest from oil, gas and coal assets. However, in LICs and LMICs fossil fuel asset stranding considerably affects state-owned enterprises (SOEs) and government revenues in general (Figure 1).

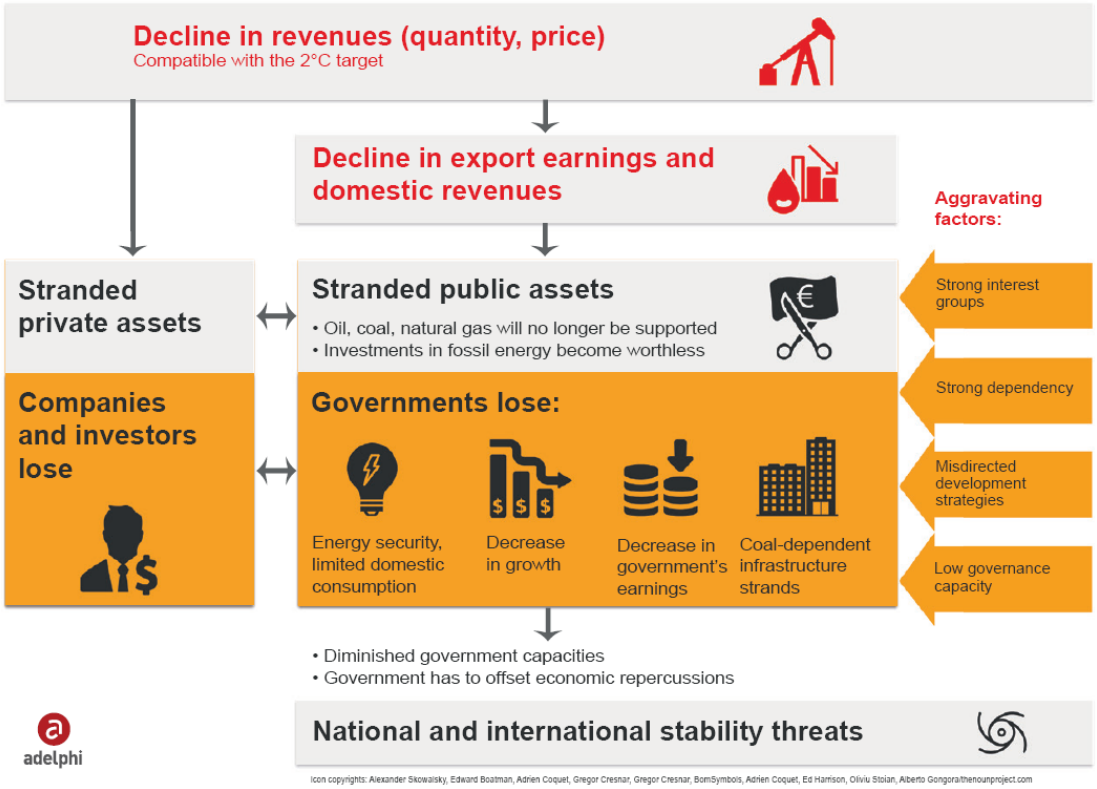
There is a growing body of literature on the value of fossil fuel asset stranding as a result of climate action. This risk is concentrated in resource-rich countries, both in the developed and developing world. Estimates vary widely due to differences in methodologies and assumptions (Text Box 4). As a result, investors may lose their investments due to the burst of the "carbon bubble" (Mercure et al. 2018).

An estimate from the Climate Policy Initiative (2014) puts the value of assets at the risk of stranding up to USD 15 trillion for both fossil fuel extraction and power. This modelling was conducted under high oil price assumptions, hence resulting in high values of assets.

More recently, the International Renewable Energy Agency (IRENA, 2017) estimated the value at the risk of stranding at USD 7 trillion for fossil-fuel-extracting assets and USD 1.9 trillion for fossil power generation, under their delayed climate action scenario. In contrast, IRENA's scenario promoting the switch to renewable energy allow to roughly halve the value of these assets at the risk of stranding (IRENA, 2017). The difference between these early and delayed climate action scenarios illustrates an important point: if the right policies are put in place early on and there are clear signals for investors, a considerable share of asset stranding can be avoided.

Thus, climate action and government policies are an important factor affecting the stranding of fossil fuel assets—as is the lack of government policies and clear signals to investors. Other drivers include the increased competitiveness of alternative technologies and fuels, the fundamental drivers of demand and supply, air pollution and health regulations as well as other government regulations or, conversely, delay in adoption or the lack of certain regulation. As the examples below illustrate, fossil fuel asset stranding is not merely theoretical: it is already happening, especially for coal and natural gas power and high-cost oil extraction (Text Boxes 5 and 6 on asset stranding in India and Ukraine respectively).

Figure 1. Impacts of fossil fuel asset stranding on different actors



Source: Adelphi as reproduced in Schlösser et al., 2017.

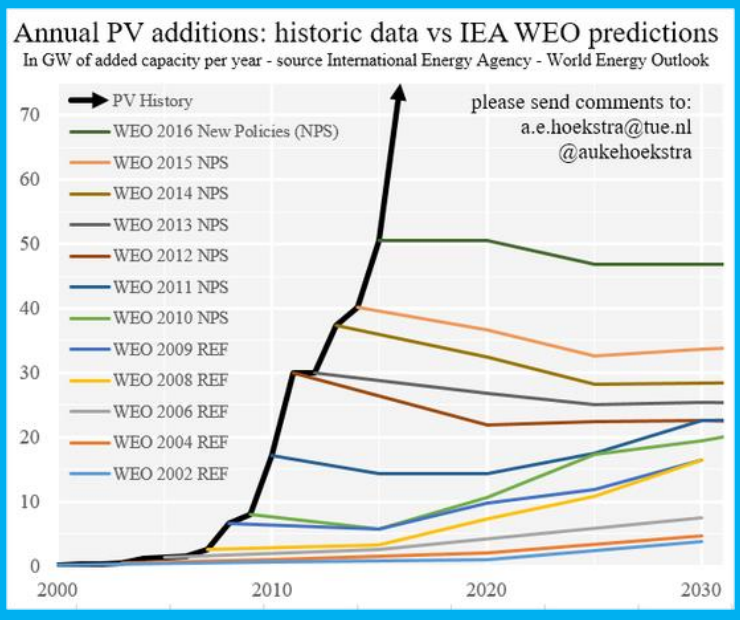
Text Box 4. The tyranny of modelling assumptions

Any attempt at assessing the implications of unburnable carbon for individual countries requires modelling. In turn, the results of such modelling can be scattered across a very wide range since they are very sensitive to assumptions about:

- Oil, gas and coal prices that themselves depend on a) factors affecting the demand for fossil fuels such as economic growth and climate action and b) factors affecting the supply of fossil fuels such as cost reductions as a result of breakthroughs in extractive technologies
- The size of the remaining carbon budget
- The viability and deployment of carbon capture and storage (CCS) technologies
- The non-energy use of fossil fuels (such as for petrochemicals, though their role is limited by the growing concerns about plastic waste)
- The cost of non-fossil energy technologies such as renewables.

Differences in these assumptions can lead to very different results. For instance, in its assumptions, the International Energy Agency (IEA) and many other energy future forecasters have systematically underestimated the decrease in the costs of renewable energy technologies (Figure 2), the shale gas revolution and, as a result, failed to predict the decrease in coal demand in 2014–2016.

Figure 2. Annual photovoltaic addition: historical data vs. IEA World Energy Outlook predictions



Source: Hoekstra (2017).

While there are good efforts to model the implications of energy transitions not only at the global level (e.g., Carbon Policy Initiative 2014, IRENA 2017), but also for individual countries, including LICs and LMICs (e.g., Bradley et al. forthcoming), there is, overall, a noticeable lack of reliable forecasting and planning in government practices (see Chapter 3 for recommendations).

Therefore this report uses a mapping based solely on established facts rather than assumptions about the future. As a result, this mapping is not a mapping of stranded assets, since most unburnable carbon is outside the projects under development or close to development. Rather, it is a mapping of how "the carbon wealth of nations" is distributed across developed and developing countries with "common, but differentiated responsibility" on climate action.

In this vein, Figure 3 maps all countries with significant fossil fuel production[3] and Figure 4 zeros in on the bottom left corner of the graph accommodating LICs and LMICs. Both figures use three empirical criteria. First, the vertical axis represents Gross National Income (GNI, current USD, Atlas method) per capita. The World Bank (2018) classifies countries with GNI per capita below USD 1,000 as low-income countries (LICs) and countries with GNI per capita below USD 4,000 as lower-middle-income countries (LMICs).

Second, the horizontal axis represents historical extraction-based emissions from oil, gas and coal from 1990 (the baseline year of the UNFCCC) to 2016. In other words, this dimension represents the degree to which these resource-rich countries have depleted their own fossil fuel reserves and the global carbon budget by extracting oil, gas and coal for both domestic consumption and exports during the period in which countries already recognized the impacts of fossil fuel use on the climate.

Third, the size of the bubble represents the size of the proved remaining reserves of oil, gas and coal combined. For both historical extraction-based emissions and the size of reserves we use data from BP (2017) and CO_2 conversion factors, adjusted for non-energy use, based on estimates from Heede (2014).

These three dimensions are in line with the principles of the Lofoten Declaration (2017) calling for (in terms of foregoing fossil fuel extraction) leadership that "must come from countries that are high-income" (upper range of the vertical axis) as well as "have benefitted from fossil fuel extraction, and that are historically responsible for significant emissions" (right range of the horizontal axis). However, it is not only leadership on unburnable carbon that can be expected to come from these richer countries, but also competition with LICs and LMICs for the opportunity to supply the last barrel of oil, cubic metre of natural gas and tonne of coal. Therefore, the size of the remaining reserves is an important factor too (size of the bubble).

[3] Therefore the mapping excludes countries that have no significant fossil fuel production at present, but have recent fossil fuel discoveries (e.g., Guyana, Madagascar, Tanzania) or actively explore for fossil fuels (e.g., Morocco).

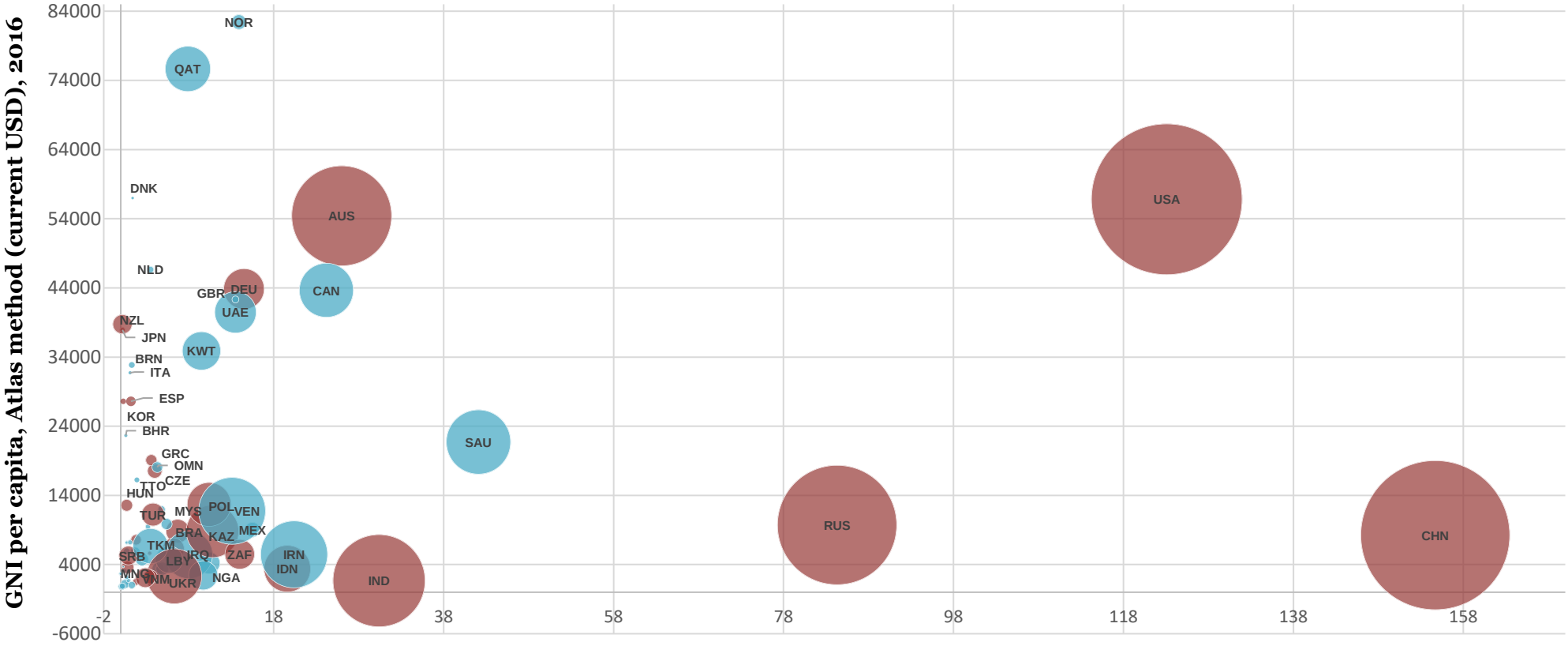
Figure 5 represents another approach to country mapping with respect to the implications of a transition away from fossil fuels. It draws on the work in progress within the Climate Change Group of the World Bank Group (Peszko 2016). Figure 5 maps all countries according to two criteria. First, the vertical access represents exposure to risks associated with decarbonization through a) Export revenue from fossil fuels as a share of GDP; b) expected rents from known fossil fuel reserves as a share of GDP; c) carbon intensity of manufacturing exports and d) committed emissions in the power sector.

Second, the horizontal access represents countries' resilience and flexibility in the light of decarbonization, understood as a function of a) GDP per capita; b) economic complexity; c) macroeconomic stability; d) financial market development and efficiency; e) quality of infrastructure; f) human capital; g) institutional quality and good governance; h) ability to absorb technology; i) ease of doing business. This mapping identifies six countries vulnerable to decarbonization: one LMIC (Bolivia), four upper-middle-income economies (Mozambique, Kazakhstan, Russia and Venezuela) and one high-income country (Kuwait). All of them are oil and gas producers, which probably indicates the use of high oil prices at the time of modelling (see Text Box on modelling sensitivities). Meanwhile, a much larger number of economies including coal producers are in the "potentially vulnerable" category.

Figure 3. Mapping of fossil fuel producing countries based on their GNI per capita (vertical axis), historical extraction-based emissions in 1990–2016 (horizontal axis) and the size of their fossil fuel reserves (size of the bubble)

Marked in red are coal-dominated countries (coal > 50% of carbon content of proven fossil fuel reserves); marked in blue are petroleum-dominated countries (oil & gas > 50% of carbon content of proven fossil fuel reserves).

Emissions from extractive processes are not included. The amounts of the carbon equivalents of fossil fuel reserves, in case of consumption, is adjusted for non-energy use.

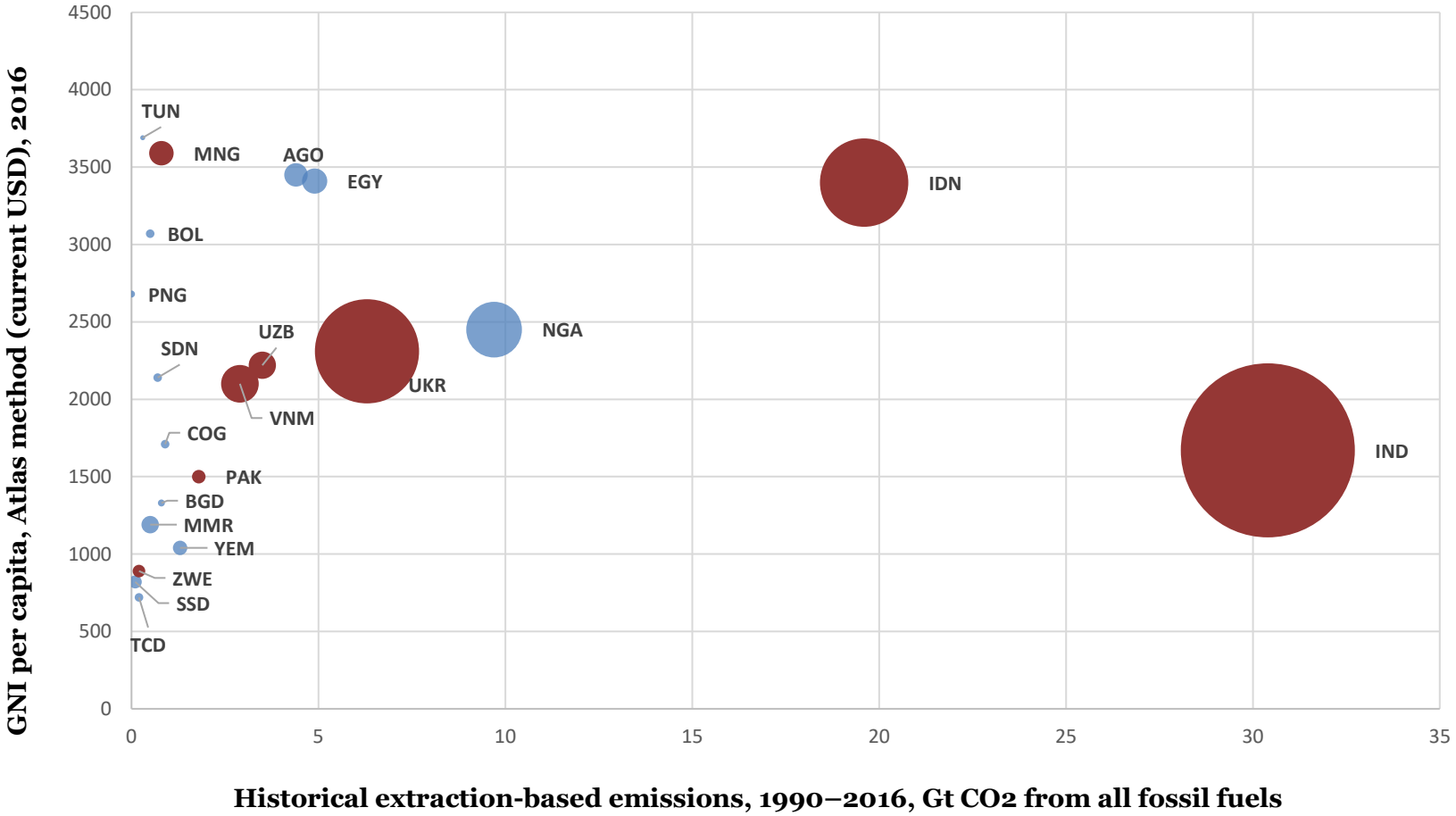


Source: Authors' own calculations based on World Bank (n.d), BP (2017) and Heede (2014).

Figure 4. Mapping of LICs and LMICs producing fossil fuels based on their GNI per capita (vertical axis), historical extraction-based emissions in 1990–2016 (horizontal axis) and the size of their fossil fuel reserves (size of the bubble).

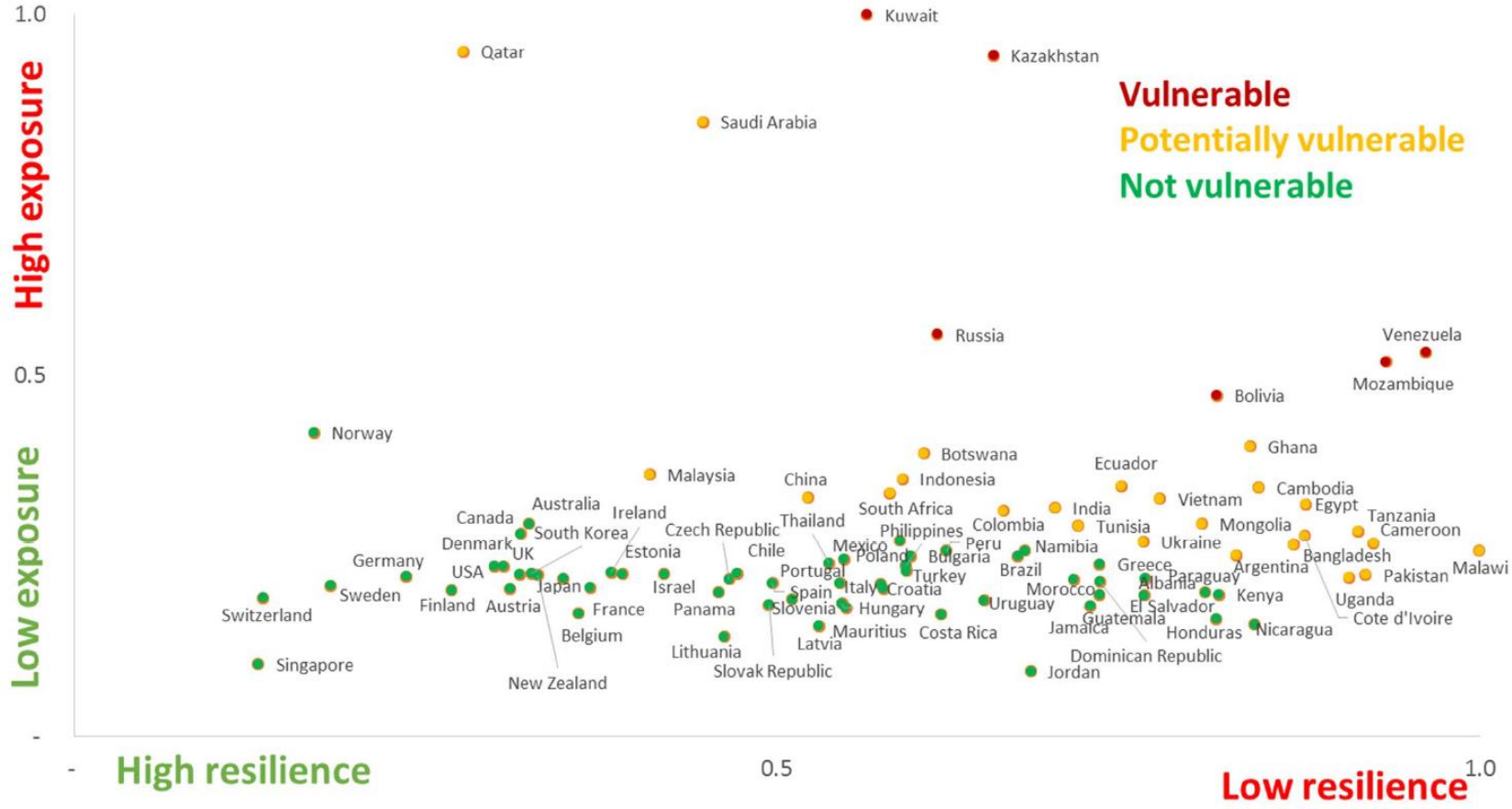
Marked in red are coal-dominated countries (coal > 50% of carbon content of proven fossil fuel reserves); marked in blue are petroleum-dominated countries (oil & gas > 50% of carbon content of proven fossil fuel reserves).

Emissions from extractive processes are not included. The amounts of the carbon equivalents of fossil fuel reserves, in case of consumption, is adjusted for non-energy use.



Source: Authors' own calculations based on World Bank (n.d), BP (2017) and Heede (2014). For source data see Annex 3.

Figure 5. Countries' vulnerability to low-carbon transition impact



Source: Peszko (2016): work in progress, the figure represents views of the authors, not necessarily the World Bank Group.

Based on both mappings as well as a literature review, the authors identified three LMICs for more in-depth case studies: India, Indonesia and Ukraine. The three countries are "potentially vulnerable" to low-carbon transition according to Figure 5 based on Peszko (2016).

All three countries have significant reserves of coal, which has the highest carbon content per unit of energy among fossil fuel types. For this reason, coal-rich countries tend to have more unburnable carbon than producers of oil and gas. In fact, India, Indonesia and Ukraine are the three largest bubbles in Figure 4. Climate policies such as carbon pricing can be significant drivers of coal asset stranding, but there are two more drivers that make coal asset stranding an issue already today. First, coal is the fossil fuel most immediately exposed to competition with renewable power generation. Second, health concerns and stricter air pollution standards also drive up the costs of coal power generation and lead to calls for its closure, including in developing countries.

In contrast, oil and gas still appear to be less exposed to the risk of asset stranding. Oil and gas prices significantly decreased in 2014–2017, making these fossil fuels more competitive, though the markets for them are also beginning to be transformed by both renewable energy technologies and electric vehicles. While there are examples of the stranding of natural gas assets, they are not as prominent as in the coal sector. The discussion on oil and gas stranding has been limited to high-cost areas in the Arctic and Canadian tar sands (McGlade et al., 2015) and thus less relevant for development cooperation.

Text Box 5. Main drivers of asset stranding in India

The Indian energy mix is witnessing a shift toward clean energy. However, given the variability of renewable energy generation and high cost of storage, coal continues to the preferred source of baseload generation.

In the meantime, the coal power sector in India is under stress and is facing a growing problem of non-performing assets (NPAs). Worrall et al. (forthcoming) list the key drivers of coal power assets stranding in India, based on the review of India-specific literature. In order of incidence, the five most frequently cited drivers are: (1) the cost competitiveness of renewable energy alternatives; (2) the low scheduling of electricity from coal-fired power plants by distribution companies (DISCOMs); (3) air pollution regulation costs; (4) water scarcity, including blocked access through government intervention; and, (5) coal shortage, such as through supply chain interruptions, or overdue payments by coal-fired power plants to coal producers. These findings are in line with the views that interviewees from India have expressed during this research project.

According to another estimate, around 74 GW of thermal capacity is stressed due to non-availability of coal and gas, lack of power purchase agreements (PPA), paucity of funds and other regulatory uncertainties. Further, around 23 GW of capacity under construction is also under threat of potentially becoming stranded. This is totalling to

around INR 4 trillion (USD 61.5 billion) of debt under stress and potential NPAs (CRISIL, 2018).

Several Indian coal companies have seen the writing on the wall and started diversification programs. For example, Coal India Limited (84 per cent of domestic coal production) recently commissioned the Coal Vision 2030 report for its consultations with stakeholders. The report states that "even in the case of coal industry in India, trends portend that in the long run the demand is likely to decrease substantially. With the increasing threat of climate change impacting humanity (irrespective of the US position) and the global funding focus on renewables, it is a matter of time when alternate clean energy would displace coal" (Coal India Limited, 2018). Coal India is one of the Indian energy companies that has also started energy diversification programs. They encompass the development of new streams of business such as coal bed methane and underground coal gasification, but also renewables. In particular, Coal India has announced plans to set up 20,000 MW of solar capacity over the next 10 years entailing investment of INR 100,000 crore (USD 15.3 billion).

The interviewees from India who have shared their opinions to inform this report differed in their views regarding the extent to which India's current policies give the right signals to investors regarding the future of coal power. There are multiple policies and regulations, over-arching and sector-specific, federal and state-level, resulting in a cacophony of guidance to energy market participants.

The issue of asset stranding in the coal power sector is likely to become more salient in coming years due to increasing air pollution and its impacts on human health from such power plants. According to the World Health Organization's World Global Ambient Air Quality Database, 11 of the 12 cities with the highest level of particulate pollution are in India (Irfan, 2018). Enforcement of anti-pollution laws will drive closure of thermal plants. Moreover, the government objective of providing universal energy access can be met through clean energy alternatives, as their costs continue to plummet in India (Institute of Energy Economics and Financial Analysis, 2017).

Text Box 6. Fossil fuel assets: The risk of stranding in Ukraine

As a net energy importer, Ukraine is a price taker in the global energy market. It is also a follower of international climate policy rather than a leader. The country's National GHG emissions reduction target under the Paris Agreement is loose. The Energy Strategy of Ukraine by 2035 prioritizes decreasing energy imports, which is planned to be achieved by an intensive increase in domestic fossil fuel extraction and, at the same time, aggressive development of the renewable energy sector (Cabinet of Ministers of Ukraine, 2017). However, some interviewees have dismissed Ukraine's Energy Strategy as obsolete since it does not take into account the most recent developments.

Indeed, Ukraine has joined the Energy Community Treaty and signed an Association Agreement with the European Union (EU). Thereby, Ukraine voluntarily undertook very demanding environmental obligations such as the establishment of an emissions trading scheme (ETS). Ukraine's government is currently working on a legal framework for a domestic ETS, which could be potentially linked to the EU ETS. Additionally, the Ministry of Environment and Natural Resources is advocating for a considerable increase of carbon tax, now at the level of just about 1 eurocent per tonne of CO_2 (Dzerkalo Tyzhnya, 2015). Ukraine's government also plans to approve a Low Carbon Development Strategy in 2018.

The resulting combined policy mix is likely to have a noticeable impact on the costs of fossil fuel power generation in Ukraine and will increase the risk of fossil fuel stranding in the sector. However, quantification of the stranding risks for Ukraine is difficult. The European Bank for Reconstruction and Development (EBRD, 2015) estimated that under a low-carbon scenario, the economic value of Ukraine's coal production would decline by USD 17 billion, with more than 53 per cent of the loss attributed to SOEs.

In Ukraine, a considerable number of coal mines are still state-owned. The government has been providing direct budget support to unprofitable mines to partially cover their operational cost and to help finance capital expenditure. For the period from 2012 to 2017, approximately UAH 2 billion (USD 220 million) of public funds were allocated to support the construction and technical re-equipment of state-owned mines (State Treasury Service, 2018). In the 1990s the World Bank started several projects trying to help diversification of coal-dependent communities around state-owned mines in Ukraine, but had to roll back the program (World Bank Project Database, n.d.) At present, there are neither internationally supported nor national government programs trying to address the looming loss of economic activity and jobs in these communities.

DTEK, the largest vertically integrated private coal company, produces 76.5 per cent of Ukraine's coal and holds 67.5 per cent of assets in the thermal power sector. DTEK is an example of a company that is aware of the current trends in the global energy market and actively seeks to diversify its assets portfolio. The company is one of the

country's largest taxpayers, contributing UAH 17 961 million (USD 702 million) to Ukraine's budget and providing 110 thousand jobs as of 2016 (DTEK, 2017).

DTEK is among the top three investors in the renewable energy in Ukraine, with a 1.4 GW portfolio in renewable energy. In addition, the company has business in the energy efficiency sector (DTEK ESCO) implementing projects under an energy service mechanism in the industrial and public sectors. Further, DTEK has a project to develop charging infrastructure for electric vehicles and is considering a gradual upgrade of its own fleet to electric vehicles (DTEK, 2017).

Nevertheless, DTEK believes that Ukraine will rely on coal-based generation for at least the next 10 years and continues to invest into an increase of coal production and gas exploration while the share of renewables in annual capital investments is still marginal. In 2016, DTEK invested UAH 3.9 billion (USD 152.3 million) in coal mining and preparation, UAH 932 million (USD 36.4 million) in oil and gas projects and only UAH 8 million (USD 312.5 thousand) in renewable energy projects (DTEK, 2017).

2.2. Domestic Consumption vs. Exports

The issues of energy transition and unburnable carbon are mid-term to long-term concerns rather than the immediate drivers of investor behaviour or pressing needs in many LICs and LMICs. Therefore energy transition requires policy planning and coherence while the quality of such strategic documents varies in LICs and LMICs.

The agenda of clean energy transition is also fundamentally different for net importers and next exporters of each of the fossil fuel types. It is worth noting, however, that net importer vs. net exporter dynamics exist not only on the national level, but also among subnational entities within each country.[4]

For net importers of oil, gas and coal, a shift away from fossil fuels means increased energy security, reduction of costs (especially during periods of high oil, gas and coal prices) and improvements in trade and currency balances. As for the domestic reserves of fossil fuels, their future should be determined by the economic viability vis-à-vis other technologies based on their true cost, that is the cost including air pollution and negative impacts on health and the environment. In recent years, air pollution from coal power has become a serious concern in many developing countries, and more stringent air quality regulations have increased the cost of power generation in some economies (Kitson et al., 2017). The same holds true for the impacts on climate—domestic consumption of fossil fuels has become subject to Nationally Determined Contributions under the UNFCCC process.

For net exporters, the transition away from fossil fuels is fraught with more difficulty. For net exporters, the loss of oil, gas and coal export markets means a reduction in the natural

[4] E.g., India is a net importer of all types of fossil fuels. However, the eastern states in India are coal-rich: they export coal to other states and have abundant coal-power generation. In contrast, renewable energy generation in India is mostly concentrated in western and southern states.

resource rents that governments and companies can capture in the form of foreign exchange. It also means the deterioration of the trade balance. Net exporters of fossil fuels also typically suffer from the so called "resource curse" and "Dutch disease" that lock in fossil fuel extraction as the dominant sector of the economy, precludes economic diversification and ultimately drives inequality (Ross, 2013). Manley et al. (2017) find that LICs and LMICs extracting fossil fuels for export purposes are more vulnerable to the vagaries of global energy markets because of a high ratio of the value of fossil fuel reserves to GDP and lack of economic diversification. Therefore, it is critical for net exporters to develop alternative export-oriented activities and activities that replace imports.

2.3. Economic Diversification for a Just Transition

The concept of fossil fuels as unburnable carbon or stranded assets has little traction in LICs and LMICs, especially when set against urgent poverty alleviation and infrastructure needs. An aggressive pro-climate agenda can be counterproductive in being seen as anti-development and even, in the terminology of some Indian commentators, as "carbon imperialism" (Prasad, 2017).

Practical conversations regarding a just transition away from fossil fuels in these countries might best be framed in terms of national goals for sustainable economic diversification (Lahn & Bradley 2016, Bradley et al., forthcoming). Indeed, for carbon-dependent countries, diversification often means the implementation of measures that lead to climate change mitigation (Pezsko, 2016).

Economic diversification is not a new topic for fossil fuel-producing countries. It has been on the agenda for many decades and has proved difficult to implement. **But this time the plummeting costs of renewables and the urgent need for climate action make economic diversification the only viable option for fossil fuel phase-out.** That is why the Paris Agreement specifically mentions economic diversification (Article 4.7 and Article 7.9.e). Economic diversification is also an integral part of the discussions of the UNFCCC Group on Response Measures and a Just Transition (UNFCCC 2016).

There is a formidable body of policy literature and guidance on economic diversification (for a review, see UNFCCC 2016). However, for most fossil fuel-rich countries, economic diversification has been a standing item on the development agenda for many decades, with little real progress. "Resource curse" and "Dutch disease" to a large extent describe the lack of such progress, especially during the period of high world prices for oil, gas and coal.

Most importantly, economic diversification requires a positive agenda, success stories to learn from and availability of viable alternatives. Indonesia is one of the few countries that has escaped the "resource curse" and created a diversified economy, which makes it an interesting case study. Indonesia offers both success and failure stories with respect to economic and energy sector diversification. The country has been a significant fossil fuel producer for many decades, but the dynamics differ between the petroleum and coal sectors. (Text Boxes 7 and 8).

Overall, best practices of economic diversification for resource-rich developing countries include:

- Developing fossil fuel resources at a slow rather than faster rate (Manley et al., 2016, Lahn & Bradley, 2016)
- Full-cost energy pricing and fossil fuel subsidy reform with the possibility of using savings of the reform for financing economic diversification and a just transition (Gass & Echeverria, 2017; Pradiptyo et al, 2016, Manley et al. 2016)
- Investment in efficient, resilient infrastructure (Lahn & Bradley, 2016; UNFCCC 2016)
- Transparent and accountable mechanisms of governing the fossil fuel sector and its revenues (Extractive Industries Transparency Initiative, 2010). These mechanisms should prevent rent-seeking behaviour such as claims of fossil fuel production subsidies (Gerasimchuk et al. 2017)
- General measures to improve institutions and the business climate to encourage private investment and competition
- Public investment in people, especially in education at all levels

There is also more specific guidance, for instance, on the establishment of sovereign wealth funds to reallocate the revenues from the fossil fuel sector development into other sectors. However, sovereign wealth funds have produced very mixed results in both developed and developing countries due to the difficulties of picking up winners (Natural Resources Governance Institute & Columbia Center for Sustainable Investment, 2014).

In view of climate policies and the plummeting costs of renewables in recent years, three more additional factors have become important for successful diversification of the energy sector. Most in-country interviews for this project have stressed the importance of:

- **The integration of sustainable development objectives, climate action and energy sector development at all levels**, through both strategic planning and relevant government structures (e.g., establishing ministries of energy and climate (environment) rather than two separate ministries);
- **Investment in and prioritization of flexible enabling conditions for the uptake of renewables**. This includes both power market design and an adequate infrastructure for grids and storage to accommodate the variable nature of renewables;

- **Provisions to allow for a just transition of workers, communities and countries**. The just transition[5] agenda is not limited to the fossil fuel sector and applies to all industries, recognizing that the shift to a low-carbon economy will sunset some types of jobs and give rise to other types of jobs. The Paris Agreement mentions a just transition in the preamble as an imperative, since a dialogue about it is mandatory for the political and social feasibility of climate commitments. The earlier and better the needs of a just transition are anticipated, the less disruptive the change will be for vulnerable groups. There is a growing body of best practices in this respect, including the lessons learned from coal phase-outs (Bridle et al., 2017, Gerasimchuk et al., 2018) and transitions in other sectors, e.g., the nuclear phase-out in Switzerland. The policies needed to help workers in moving into new jobs vary depending on national and local circumstances.

In the context of LICs and LMICs, these recommendations on economic diversification are important not only for existing fossil fuel producers, but also to newcomers—the countries that have just recently discovered commercial fossil fuel reserves, e.g., in Africa. New producers need to integrate extractives development into sustainable economic diversification plans from the outset (Gueye, 2018; Bradley et al., forthcoming). Some countries have experienced growth disappointments after major oil finds, and economic problems have set in shortly thereafter (Cust & Manley 2017).

[5] In 2015, the International Labour Organisation (ILO), a UN body, published "Guidelines for a just transition towards environmentally sustainable economies and societies for all." Given the ILO's nearly universal membership, this approach is therefore applicable globally. These multi-sector guidelines rely on the four pillars of the Decent Work Agenda—social dialogue, social protection, rights at work and employment—and have quite specific recommendations, including on sectoral and industrial policy, skills and support for job seekers. However, in the context of climate talks there exist at least two more interpetations of "a just transition": one focused on the increasing costs of the green economy to households and other consumers and another that extends to a just transition for displaced communities. This report sticks to the just transition agenda as defined by the ILO.

Text Box 7. Economic diversification in Indonesia: Oil and gas

Indonesia's oil and gas sector is controlled by the state, with SOE Pertamina acting as the main government agent. Foreign companies can extract oil and gas under Production Sharing Contracts (PSCs) with the Indonesian government, but Pertamina is currently in the process of taking over several PSCs from foreign investors.

Indonesia's oil and gas reserves were and are relatively limited. Researchers note a paradigm shift in how the government viewed oil and gas reserves. In earlier years, oil and gas development was export-oriented and perceived as an export cash cow of the government. However, as Indonesia's population and domestic energy consumption needs grew, the oil and gas reserves were getting depleted, the government started treating them as strategic resources for supplying domestic energy to boost economic development rather than as commodities to generate revenues (Natural Resources Governance Institute, 2015). In 2004, due to the increase in domestic demand, Indonesia turned from being a net exporter to a net importer of oil (in 2018 the country is still a net exporter of natural gas).

Globally, Indonesia has one of the highest levels of the government take in the sector of oil and gas extraction. The government take, through taxes and government's share in PSCs, amounts to 81 per cent (for comparison: in Norway the government take is 76 per cent and in Brazil just 56 per cent, see Martén, Whittaker, & de Bourio, 2015). Indonesia petroleum sector regulations have also been changing and created a lot of uncertainty for investors (Duhiti, 2018). A positive side effect of this was the limited manifestation of the "resource curse" and unimpeded diversification of the Indonesian economy.

At the end of 2014, when oil prices dropped, Indonesia implemented a large-scale reduction of its generous subsidies for gasoline and diesel consumption. As a result, it saved IDR 211 trillion (USD 15.6 billion) on fossil fuel subsidies, equal to 10.6 per cent of all government expenditure. The fuel subsidy savings in 2015 were reallocated to major investments in social welfare and infrastructure through increased budgets for ministries (IDR 148 trillion or USD 10.1 billion), state-owned enterprises (IDR 63 trillion or USD 4.5 billion) and transfers for regions and villages (IDR 35 trillion or USD 2.5 billion) (Pradiptyo et al. 2016). However, with elections approaching in 2019 and oil prices again on the rise, in early 2018 Indonesia regulated fossil fuel price caps again, effectively re-introducing subsidies (Varagur, 2018).

Text Box 8. Economic diversification in Indonesia: Coal

Coal mining is mostly private in Indonesia, and the rate of extraction has been fast. Indonesia is the world's largest exporter of coal, and its export volume has been increasing rapidly (Schlösser et al., 2017).

In 2014–2016 some of Indonesia's coal export markets and, in particular, China have reduced their demand and prices decreased. Over the medium term, Indonesia is faced with a possibility of coal oversupply in the export market. Meanwhile, the government has also been considering an increase in domestic coal consumption. To manage this shift, the government decided to cap both coal production and exports under Rencana Pembangunan Jangka Menengah Nasional (RPJMN), the National Medium-Term Development Plan for the period 2015–2019 (BPKP, 2015). However, these caps have been lifted every year since the introduction since private coal companies were rushing to supply export markets that provide more lucrative returns (Prakoso, 2017). Indonesian coal producers are likely to continue the rush for exports since the price differential remains considerable in the light of Indonesia's introduction of a ceiling price for coal consumption by domestic utilities (Platts, 2018).

Table 3. Indonesia's coal cap: plan and practice, Mt

	2015	2016	2017	2018	2019
Production cap according to RPJMN 2015–19	425	419	413	406	400
Production, actual	462	434	-	-	-
Domestic sales according to RPJMN 2015–19	102	111	121	131	240
Domestic market obligation, actual	51	63	-	-	-
Exports according to RPJMN 2015–19	323	308	292	275	160
Exports, actual	411	371	-	-	-

Source: RPJMN 2015–2019 indicators from BPKP (2015), factual indicators based on BP (2017).

The ceiling price for coal consumed by domestic power plants is only one of the numerous subsidies that exist in Indonesia to support the coal power sector (Attwood et al, 2017). These subsidies are one of the roadblocks in the way of renewable power in Indonesia. Other obstacles include low power purchase prices, frequent changes to policy, conflicts of interest among government agents, regulatory delays and lack of recognition of the environmental benefits of renewable energy. As a result, Indonesia is lagging behind China, India and many other developing countries in deploying renewables. The country is on its way to miss its target of 23 per cent of renewables in its energy mix by 2025. The existing trends in the power sector also undermine Indonesia's commitments under the Paris Agreement as well (Bridle et al., 2018).

Chapter 3. Recommendations to Switzerland

This chapter divides recommendations related to unburnable carbon into four umbrella groups. First, Switzerland should use its role as the global financial hub to help stop funding fossil fuels and shift financial flows toward greener projects. Second, Switzerland should help develop and promote a positive narrative on a shift away from fossil fuels. Third, Switzerland needs to work on policy coherence and aligning development policies with the Paris Agreement at different levels: within its own government and in engagement with both developed and developing countries. Fourth, Switzerland can contribute to economic diversification of carbon-dependent LICs and LMICs for a just transition.

With no fossil fuel production or coal power, Switzerland potentially falls in the same category as some other countries that are first movers on limiting fossil fuel supply, e.g., France or New Zealand. Switzerland's possible engagement on unburnable carbon and stranded assets should act to its strengths as a country whose opinion matters for international finance, investments and better development policies with respect to LICs and LMICs. Switzerland has already embraced some of this agenda, e.g., through its participation in the Friends of Fossil Fuel Subsidy Reform and the Powering Past Coal Alliance.

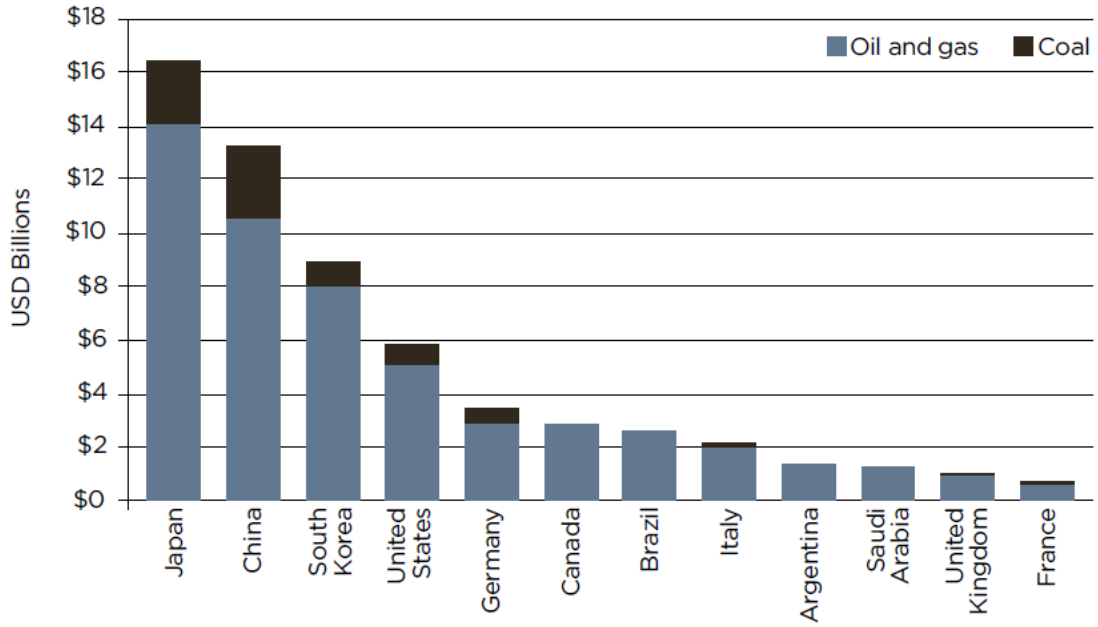
3.1 Help Shift Financial Flows Away From Fossil Fuels

An absolute majority of stakeholders interviewed to inform this report (see Acknowledgements) underscored Switzerland's important role in influencing both public and private financial flows internationally, including through multilateral development banks and funds and development assistance in LICs and LMICs. However, it is also recognized that Swiss financial institutions and some Swiss companies (e.g., Glencore, ABB) have significant fossil fuel interests. At the same time, the Swiss Federal Council has noted that "the Swiss financial sector remains insufficiently focused on climate-friendly investments" (The Federal Council of Switzerland, 2017).

In other words, the most significant contribution from Switzerland in support of a just transition away from fossil fuels would be getting the signals right for Swiss and international investors, both public and private. Being a first mover on fossil fuel supply and power is just a means of broadcasting this signal.

At present, almost all IFIs and donor countries have oil, gas and coal projects in their portfolios. Figure 6 from Doukas et al. (2017) maps out the countries that provided the highest amounts of export finance for fossil fuels in 2013–2015.

Figure 6. Annual Average of Public Finance for Fossil Fuels by Top 12 G20 Countries, 2013–2015



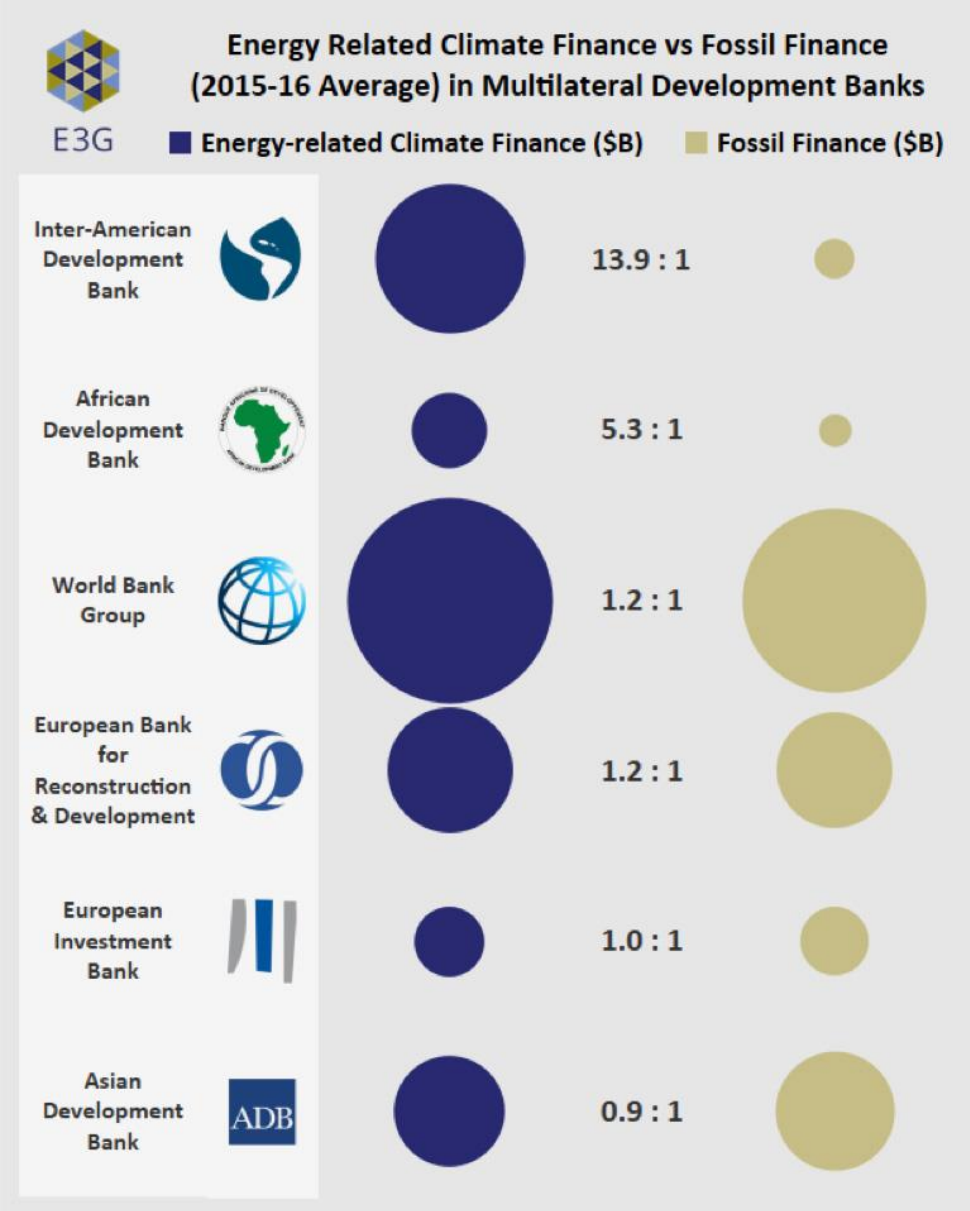
Source: Doukas et al. (2017) based on the Oil Change International "Shift the Subsidies" Database. Note: For all figures, data does not include majority government-owned banks that function commercially or quasi-commercially, which are particularly relevant for India and China.

Figure 7 is sourced from Wright et al. (2018) and compares energy-related climate finance provided by multilateral development banks with their fossil fuel project portfolios in developing countries. It ranks the Inter-American Development Bank (IADB) as a leader and the Asian Development Bank (ADB) as a laggard in this respect.

Switzerland is an influential member in the World Bank Group, African Development Bank (AfDB), Asian Development Bank (ADB), European Bank for Reconstruction and Development (EBRD), Inter-American Development Bank (IADB), Global Environment Facility (GEF) and Green Climate Fund (GCF). Switzerland can and should use its voice to promote a shift of these IFIs' flows away from fossil fuels toward sustainable development needs at two levels:

- As part of general governance via the Boards of Directors;
- Through participation in decision making on specialized trust funds it supports within each of the IFIs, since such specialized trust funds can help provide more targeted development assistance.

Figure 7. Ratio of Energy-related Climate Finance to Fossil Finance Directed to Developing Countries (2015–16 Average), from High to Low



Source: Wright et al. (2018) based on analysis of OECD Climate Finance data and Oil Change International database. Ratio covers investment in developing countries only. IFC only includes data for 2015.

In recent years and especially after the signing of the Paris Agreement in 2015, some international donors have already been taking increasing account of the issues of unburnable carbon and potential stranding of fossil fuel assets.

In broad terms, both IFIs and development agencies deal with the issue of unburnable carbon and stranded assets at three levels:

- In risk assessments for their existing project portfolio, along with the assessment of financial and political risks
- In their strategies and assessments of future projects, including at the level of sectors and countries
- In engagement pieces (e.g., reports, workshops) with aid recipients and other donors.

For both existing and future project assessments, donors have been applying several approaches to restricting fossil fuel extraction and power in their project portfolios:

- Shadow carbon pricing, i.e., an application of a hypothetical carbon price to projects to see the impact on their economic viability;
- Portfolio GHG emissions accounting and ceilings on the absolute volume of GHG emissions that an aid-recipient project can receive;
- Prohibition of financing for certain types of fossil fuel projects;
- Development of technical assistance tools and financial products that suit the increasing demands of climate countries to help them align their development with their NDCs under the Paris Agreement;
- Provision of technical assistance and finance for economic and energy sector diversification.

The World Bank Group is generally seen as a leader in this area. According to the Directions for the World Bank Group's Energy Sector, the Group will provide financial support for greenfield coal power generation projects only in rare circumstances (World Bank, 2013). In December 2017, the World Bank Group announced that it would no longer finance upstream oil and gas after 2019 (World Bank, 2017). The World Bank is also in the process of assessing the climate and development nexus and its project portfolios in 56 countries. The assessment has been initiated within the Climate Change Group of the World Bank Group (Peszko, 2016).

Similar trends unfold at the level of bilateral development finance. For instance, the French Development Agency AFD, in its hybrid role of a development agency and a bank, made a commitment in 2012 not to fund coal power plants (AFD, 2017). AFD is currently in the process of aligning its funding strategy with the Paris Agreement.

Figure 8 presents a summary of the current guidelines of traditional multilateral development banks with respect to finance for fossil fuel projects. These examples can help exchange existing best practices, but indicate the need for improvement. As an influential member of multilateral development banks, Switzerland can help promote this agenda.

While some traditional bilateral and multilateral export finance institutions are likely to progress with restrictions on fossil fuel projects, there are growing concerns about the role of new players in this area and in particular Asian banks. At the same time, public finance policies have ripple effects on the private sector, compounding leading banks' motivation for reconsidering their approaches to fossil fuel projects in their portfolios.

Figure 8. Fossil fuel policies of multilateral development banks

Bank	Coal Policies	Upstream Oil and Gas Policies	Downstream Oil and Gas Policies
African Development Bank	5 criteria for coal finance; development impact, transition towards green growth, environmental responsibility, most appropriate technologies, offsetting measures	Oil and gas exploration is excluded.	Lack of exclusions
Asian Development Bank	"Selectively support coal-based power projects if cleaner technologies are adopted and adequate mitigation equipment and measures are incorporated" "will not finance coal mine development except for captive use by thermal power plants"	For oil, both exploration and development excluded. For gas, exploration is excluded but development is permitted.	Lack of exclusions
European Bank for Reconstruc-tion & Development	Tripartite test to "screen all investments in coal-fired generation or associated infrastructure, including thermal coal mining". Shadow carbon price is applied. Tests also apply to coal mining.	No exclusions	Lack of exclusions
European Investment Bank	"All fossil fuel power plants…must be economically justified based on a cost benefit analysis – including a carbon price …Have CO2 emissions of less than the EPS (Emission Performance Standard)" [550gCO2/kWh].	Not funding early stage exploration or appraisal, though could finance production.	No exclusions except EPS standard
Inter-American Development Bank	Supporting "those Coal Plants…designed to use the best appropriate available technology to allow for high efficiency and therefore lower GHG emissions intensity, and to meet internationally-recognized best practices and standards".	No exclusions	No exclusions except minimum performance criteria
World Bank Group	"Only in rare circumstances… meeting basic energy needs in countries with no feasible alternatives to coal and a lack of financing for coal power would define such rare cases". Screening criteria apply to "associated transmission infrastructure" and "coal mining". IFC has begun tracking FI clients' exposure to coal and cutting high risk intermediary lending.	Excluding any upstream oil and gas from 2019, including exploration, drilling and operating wells.	Lack of exclusions

Source: Wright et al. (2018). Colour coding implies assessment according to its full scale (of which the colouring in the figure is only part of the range): Dark Green = Excellent, Green = Good, Orange = Average, Red = Lack of progress, Grey = N/A.

3.2. Help Develop a Positive Narrative on Energy Transition

As noted in both Chapters 1 and 2, some of the existing narratives on unburnable carbon and especially stranded assets are negative and can be counterproductive in LICs and LMICs. Depending on circumstances, both negative and positive narratives can be used, but there is also a general lack of positive agenda for an energy transition away from fossil fuels.

Switzerland's opinion matters when it comes to investment decisions. Switzerland is also seen as a country that has neither a post-colonial nor "new colonial" agenda. In this capacity and without patronizing, Switzerland can help create the narrative on the transition away from fossil fuels as financially savvy and innovative. A positive decarbonization agenda should:

- Frame clean energy transition as an opportunity for development rather than "carbon imperialism," e.g., help stress the benefits of clean energy for health—an agenda that can be taken up as a series of country-owned movements;

- Normalize the concept of fossil fuel phase-outs by referencing best practice examples from different countries and sectors, e.g., Switzerland's own nuclear phase-out;
- Mainstream the concept of fossil fuel phase-outs in the work of other intergovernmental organizations, particularly those where Switzerland plays an important role such as the OECD, SDG processes, ILO and WHO.

As explained above, should Switzerland take on the role of first mover on fossil fuel supply, it will not be alone. Rather, it can coordinate with some other donors, or even help coordinate them on this agenda.

The project interviews revealed that at least some traditional donors are in the process of reconsideration of their development assistance policies. However, the full mapping of such reactions requires additional research and is partly hindered by the fact that not all internal regulations of IFIs or development agencies are publicly available. Meanwhile, it is also likely that like-minded IFIs and governments can share such information with Switzerland if requested.

Several donors have commissioned reports and workshops for engagement with aid-recipient countries and peer donors on the issues of unburnable carbon. For example, The UK Department for International Development (DFID) to a certain extent tries to coordinate other donors and has commissioned the Chatham House to analyze the asset stranding risks for the group of African and Latin American countries with recent oil and gas discoveries (Lahn & Bradley, 2016; Bradley et al., forthcoming). A closer cooperation between SDC, SECO and DFID seems logical in this respect.

Other donors have also started similar engagement activities. EBRD has commissioned engagement materials on the risk of asset stranding and government-revenue loss in the carbon-dependent countries where it operates (EBRD, 2015). Similarly, IADB published on the same topic and the situation in South American countries (Caldecott et al. 2015, Caldecott et al., 2016). The German Development Agency GIZ has published a report on the risk of stranding in carbon-dependent nations (Schlösser et al., 2017) and AFD has commissioned similar work for some of the countries where it works, such as South Africa. However, in many cases such engagement pieces are initiated within the climate units of these institutions and need a lot of follow-up before they translate into institution-wide policies. They are first, important steps in the direction of development policies compatible with the Paris Agreement.

3.3. Ensure Policy Coherence for Sustainable Development

Using the sea metaphor, a ship will not get stranded if a lighthouse is in sight. The reverse is true as well: as a Chinese proverb puts it, "a fallen lighthouse is more dangerous than a reef" (Stone, 2006, p. 139). But it is similarly dangerous when there are several lighthouses—some functional and some fallen—pointing in different directions.

Achieving policy coherence for sustainable development is a difficult, but necessary condition of delivering the Paris Agreement. To this end, policy coherence needs to be achieved at three levels:

- Among different agencies of developed country governments, including the Swiss government
- In intergovernmental organizations (IGOs) and IFIs
- Among different agencies within aid-recipient countries

For Switzerland, such coordination for policy coherence involves, at the federal level, SDC, SECO, Swiss Office for the Environment (BAFU), but also the agencies in charge of international investment cooperation such as the State Secretariat for International Finance (CIF), the Swiss National Bank, SERV Swiss Export Risk Insurance. Improved coordination on the issues of unburnable carbon can ultimately help avoid the risk of fossil fuel asset stranding for Swiss public and private financial institutions and companies.

The reference to Switzerland's international commitments such as the Paris Agreement or membership in the Powering Past Coal Alliance can possibly help to facilitate domestic conversations. PPCA's commitment on coal finance, for instance, means that Switzerland has undertaken not to provide, through its public finance institutions, loans or loan guarantees to coal power plants without operational CCS.

At the international level, Switzerland can help facilitate dialogues on policy coherence within many IFIs (see Section 3.1) and IGOs, e.g., the United Nations system, including the SDG processes, OECD Development Assistance Committee (and through DAC peer reviews that include the "Planet Section"), International Energy Agency and the Extractive Industries Transparency Initiative.

Many LICs and LMICs suffer from a chronic lack of coordination between the ministries of environment, ministries of finance, ministries of energy, ministries of economic development and other government agencies. In some cases, donor involvement can help inter-agency coordination in LICs and LMICs.

Many countries prepared their NDCs and domestic low-carbon targets as aspirational development trajectories and now have to align other policies with this vision. As demonstrated by the Indonesian example with the unlikely 23 per cent renewables target (Text Box 8), such alignment can be very challenging. Many LICs and LMICs also follow an "all-of-the-above" approach in both climate and energy policies, and realization of the possible trade-offs between different options and the need for prioritization can help improve policy coherence.

Overall, there is an increase in client countries' requests to multilateral and bilateral donors for technical assistance and financial products that can help them deliver their NDCs. The World Bank Group and the AfDB in particular have received many such requests. These requests can be used as an opportunity to align NDCs and long-term energy strategies of developing countries with evidence-based scenarios of energy markets developments, including the unburnable carbon agenda.

The next round of NDCs under the UNFCCC process (to be communicated by 2020) provides an opportunity for countries to include targets to limit fossil fuel production and use. Parties can specify the policies that will support these targets, such as fossil fuel subsidy reform, increased carbon and energy taxation, deadlines for coal phase-outs and for extraction of oil and gas, moratoria on new coal, oil and gas projects, and transition plans for fossil fuel-dependent workers and communities. Parties can also map out a managed fossil fuel phase-out through their long-term low greenhouse gas emissions development strategies (which the Paris Agreement invites them to submit by 2020).

3.4. Support Economic Diversification for a Just Transition

The alignment of LICs' and LMICs' development with climate goals also mandates the development of viable alternatives and funding for projects related to economic and energy sector diversification, starting with infrastructure and clean energy finance. A lot of Switzerland's development aid already promotes economic diversification, such as its work with the UN Industrial Development Organization to support clean tech.

However, there are some more areas that merit the special attention of Switzerland based on the findings of this research project:

- All solutions that can bring down the costs of integrating renewable energy into the existing energy market systems, including technology transfer with special focus on storage and grid balancing as well as technical assistance with flexible designs of power markets (see Text Box 9 on India-specific examples);
- Solutions for managing an electricity grid with significant trading across borders—an area where Switzerland has significant experience;
- Financial innovation for financial security mechanisms in the energy sector and the development of bankable green projects and green non-financial products suitable for investors;
- Assistance with development of new transferrable skills (both technical and soft) of workers dependent on high-carbon activities, including entrepreneurship skills that could help people find a place in the new green economy (see Text Box 10 on Ukraine for more context).

These three elements are an agenda owned and promoted by developing countries themselves. In particular, finance ministers of climate vulnerable countries (also known as the V20, though the group's membership includes 48 countries) have repeatedly called for significant mobilization of public and private finance for climate action at the international, regional and domestic levels (World Bank, 2015).

The International Solar Alliance (ISA) is another excellent example of a diversification initiative coming from LICs and LMICs themselves. ISA was launched by India, with support from France, in 2016 (International Solar Alliance, n.d.). ISA seeks to facilitate joint efforts of 121 solar-rich countries to achieve economies of scale and reduce the cost of finance and the cost of technology. ISA seeks to mobilize more than USD 1 trillion of investments needed by 2030. The objective of finance mobilization turns ISA into a platform of cooperation between solar-rich developing countries and developed countries prioritizing green finance agenda such as France, the United Kingdom and the Netherlands.

Switzerland can also support this transformative agenda by engaging more with both V20 and ISA. Another important platform for this agenda is the Clean Energy Ministerial that Switzerland can join as well. The Clean Energy Ministerial's energy investment and finance activities, promoted by the Nordic members, can be of particular relevance to Switzerland (Jungcurt, 2018).

The energy transition agenda is not limited to the fossil fuel sector and applies to all industries, e.g., transport. The Paris Agreement mentions a just transition in the preamble as an imperative, since a dialogue about it is mandatory for political and social feasibility of climate commitments. The earlier and better the needs of a just transition are anticipated, the less disruptive the energy transition process will be for vulnerable groups and countries. There is a growing body of best practices in this respect, including the lessons learned from coal phase-outs and transitions in other sectors, e.g., the nuclear phase-out in Switzerland. Switzerland's effort to promote the switch from conventional to electric vehicles is also an item that can benefit from exchanging lessons learned internationally.

If implemented together, these groups of recommendations will help Switzerland get the signals right for investors and thus promote the shift of finance from fossil fuels to a low-carbon economy and the broader climate and sustainable development agenda.

Text Box 9. Recommendations on India-specific technical assistance for decarbonization of the power sector

I. Regulatory

Re-design of power markets through the creation of a peaking/ancillary service market that will ensure that:

- ✓ Coal power plants are utilized for peak hours with coal becoming a balancing fuel along with intermittent renewable capacity:
- ✓ Price signals for flexible generation are strong. Such signals will encourage investors to retrofit old power plants or replace them with plants for flexible generation. However, currently in India delta between peak and off-peak price is low, so there is no clear price signal.

Development of a single planning document for power capacity expansion:

- ✓ Generation capacity is being created based on multiple planning documents by the government. This should be replaced by one capacity planning document providing a clear vision, followed by a mid-term review of its implementation to reflect any recent developments (technological innovation, change in policies impacting choice of fuel etc.).

Allowance of a Memorandum of Understanding (MoU) route along with a competitive bidding route:

- ✓ Due to the lack of competitive bids in the market—or on account of dishonouring of PPAs by electric distribution utilities (DISCOMs)—privately owned power plants are at a disadvantage. The regulator needs to allow both MoU and competitive bidding routes and companies can be benchmarked and competing based on their performance.

Compliance with emission standards:

- ✓ Develop star rating for thermal plants like Bureau of Energy Efficiency star rating program for appliances, involving both national and international agencies.

II. Development

Infrastructure Development:

- ✓ Strengthen distribution networks to allow DISCOMs to offtake more and intermittent power
- ✓ Deploy tools for demand forecasting, renewable energy generation forecasting, grid balancing, smart grids, smart meters etc.

Economic and Social Development:

- ✓ Funds collected from fossil fuel production and consumption should be used for economic and social development as well as for a just transition
- ✓ Assistance is required in building strategic partnership with neighbouring countries like Nepal, Bhutan and Bangladesh to integrate and mutually support their grids. E.g. surplus base load power can be exported from India in exchange for peaking these countries' significant hydro capacity that will also help in grid balancing.

III. Financial Solutions

- ✓ Introduce an innovative payment security mechanism
- ✓ Attract more funding through innovative payment mechanisms such as payback or return on investment through savings on electricity bills
- ✓ Promote green instruments such as green banks and green bonds for boosting investment for clean energy.

Text Box 10. Recommendations on Ukraine-specific technical assistance on a just transition for coal mining communities

- Learn from the past: prepare a study on why previous attempts (World Bank Project Database, n.d.) on reskilling ex-miners were not successful and how new projects can be designed differently for a higher impact.
- Support the initiation and organization of discussions and stakeholder consultations on the need for better planning and anticipation of just transition needs of coal-dependent communities in Ukraine.
- Support the development of transition plans for towns where coal mines are planned to be closed in the near future. Coal mining regions have all the infrastructure (electricity lines, railway) and labour needed for the transformation of these regions to industrial parks. Energy strategy of Ukraine by 2035 envisions that social and environmental mitigation for each mine and social development programs for coal mining regions will be prepared. However, this work has yet to start.
- Design and implement professional training programs for ex-miners and associated professionals (diversified by age and gender) to develop skills and knowledge required for new jobs and entrepreneurship.
- Ensure coordination with other donors on designing transition plans and providing other support to coal mining regions.

Conclusions: Proposed Next Steps

The unburnable carbon agenda outlined in this report requires large-scale, ambitious action. However, in the context of Swiss Development Cooperation, its implementation can be launched with several initial steps:

- An internal review and discussion within SDC
- A briefing for other federal agencies, including SECO, BAFU and other bodies
- A knowledge event in Bern or Geneva open to civil servants and the broader public (possibly in Traverse format)
- An international workshop with countries and IFIs that are first movers on limiting fossil fuel supply and power (possibly in cooperation with Chatham House)
- Policy briefs and other communication materials such as op-eds and articles in English, German and French. For LICs and LMICs, these materials can also be made country-specific.

IISD has both capacity for and interest in supporting SDC in delivering these proposed steps.

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ANNEX 1. QUESTIONNAIRES USED FOR PROJECT INTERVIEWS

a. International interviewees

1. Does the issue of fossil fuel asset stranding (fossil fuel assets losing their value and becoming uneconomic) come up in your work? If yes, how?
2. Which factors may lead to stranding of fossil fuel assets in low-income and lower-middle-income countries, if any? Lack of demand? Health concerns and regulations? Anything else? (LICs are with GNI up to USD 1,000 per annum; LMICS are with GNI up to USD 4,000 per annum - including e.g., India, Indonesia, Nigeria, Viet Nam, Ukraine)
3. Do energy strategy documents of your organisation address the transition risks of declining demand for fossil fuels for low-income and lower-middle-income countries? How?
4. In your experience, do low-income and lower-middle income countries anticipate the declining demand for fossil fuels as part of energy transition?
5. How can intergovernmental organisations and cooperation between governments help low-income and lower-middle-income countries reduce dependence on extraction of fossil fuels and generation of fossil fuel power?
6. Which countries, sectors and groups of people can be most affected by the transition away from fossil fuels? Are these groups affected already?
7. What measures can help support a just transition for these vulnerable groups? Does your organisation already implement any of these measures?
8. How should a just transition for these negatively affected groups be funded? (E.g. in China and Canada, such transitions are partially funded by taxes on fossil fuels)
9. What are the best platforms and mechanisms, at a national and international level, to identify the best solutions and sources of funding for a just transition away from fossil fuel extraction and fossil fuel power?
10. The Powering Past Coal Alliance unites over 30 national and subnational governments as well as some companies whose ambition is “to accelerate clean growth and climate protection through the phase-out of … existing traditional coal power” and to place “a moratorium on any new traditional coal power stations.” Does this alliance create value in your opinion? How can PPCA become more attractive to low-income and lower-middle-income countries ?
11. Do you or your colleagues plan to attend UNFCCC intersessional in Bonn? IISD and its partners organise an event on “Enhancing ambition by addressing fossil fuel supply and ensuring a just transition” on 5 May 2018. We will welcome your participation.

This interview is conducted as part of the project mapping views of different countries and stakeholders on changing patterns of energy supply. In the written report, we will not attribute any quotes to individuals or organisations and provide summary points across all people we will have interviewed. However, we would like to give credit where credit is due and recycle quotes from the materials already available in the public domain.

b. LMIC interviewees (India, Indonesia, Ukraine)

1. Does the issue of fossil fuel asset stranding (fossil fuel assets losing their value and becoming uneconomic) come up in your work? If yes, how?
2. The International Energy Agency has repeatedly underestimated the growth of renewable energy generation in their forecasts, if compared with the actual growth in recent years. This may be because renewable energy costs dropped more than expected for all technologies, for instance, down to 4¢/kWh and even 2¢/kWh for solar in Mexico, India and the Middle East. Do you think the mid-term and long-term energy strategy documents of your country (your organisation) sufficiently reflects the risk of declining demand for fossil fuels and more competitive renewables?
3. Which factors may lead to stranding of fossil fuel assets in your country, if any? Lack of demand? Health concerns and regulations? Anything else?
4. What does your country (your organisation) need to reduce dependence on extraction of fossil fuels and generation of fossil fuel power?
5. How can cooperation between governments help your country (your organisation) reduce dependence on extraction of fossil fuels and generation of fossil fuel power?
6. In your country, which parts of the economy and groups of people can be most affected by the transition away from fossil fuels? Are these groups affected already?
7. What measures can help support a just transition for these vulnerable groups? Are any of these measures already being implemented?
8. How should a just transition for these negatively affected groups be funded? (E.g., in China and Canada, such transitions are partially funded by taxes on fossil fuels)
9. What are the best platforms and mechanisms, at a national and international level, to identify the best solutions and sources of funding for a just transition away from fossil fuel extraction and fossil fuel power?
10. The Powering Past Coal Alliance unites over 30 national and subnational governments as well as some companies whose ambition is “to accelerate clean growth and climate protection through the phase-out of … existing traditional coal power” and to place “a moratorium on any new traditional coal power stations.” Does this alliance create value in your opinion? Do you think national or subnational governments in your country (your organisation) may be interested in cooperating in PPCA?
11. Do you or your colleagues plan to attend UNFCCC intersessional in Bonn? IISD and its partners organise an event on “Enhancing ambition by addressing fossil fuel supply and ensuring a just transition” on 5 May 2018. We will welcome your participation.

This interview is conducted as part of the project mapping views of different countries and stakeholders on changing patterns of energy supply. In the written report, we will not attribute any quotes to individuals or organisations and provide summary points across all people we will have interviewed. However, we would like to give credit where credit is due and recycle quotes from the materials already available in the public domain.

ANNEX 2. CARBON BUDGET ALLOCATION SCENARIOS

Principle of Carbon Budget Allocation	Rationale	Degree of Stranding of Low-Income Countries' Reserves	What Else Gets Most Stranded?
Prioritization of the lowest-cost reserves up to the limit of the carbon budget	Optimizes pure economic efficiency, with decisions made globally for the long-term	Significant	Almost all non-Middle Eastern oil reserves, as well as some coal depending on approach
An escalating tax on fossil fuel consumption or production, applied in most or all countries	Combines economic optimization and political incrementalism	Significant, but depends on tax levels and escalation rate	Coal; long-lived, high-cost assets around the globe; high-cost oil and gas
Failure to act in the short-term, requiring rapid emission cuts at some later date	Continues the current trend of insufficient action	Most	Any reserves not extracted in the next 15 to 20 years, in all locations
Negotiated "de-capacity" process in proportion to reserves	Relying on simplest negotiated mechanism; has precedents such as the Kyoto Protocol	Shared proportionally to proven reserves	Shared proportionally to proven reserves
Negotiated based on the United Nations Framework Convention on Climate Change's (UNFCCC) underlying principle of "Common But Differentiated Responsibilities and Respective Capabilities"	Extending the historical demand-side accounting of the UNFCCC to the supply side	Least compared with other scenarios, depending on the balance of weight given to historical responsibility for extraction and ease of economic diversification	High-cost reserves of fossil fuels, in particular, in the Arctic, offshore, U.S., Canada, Europe, Australia, etc.

Source: based on Muttitt (unpublished); Carbon Tracker Initiative, 2014; McGlade & Elkins 2015; Kartha et al., 2016, Kartha et al., 2018; Caney, 2016.

ANNEX 3. PROVED RESERVES OF FOSSIL FUELS IN LICS & LMICS, CO_2 IF EXTRACTED AND BURNED

Shaded in grey are LICs, shaded in red are target countries (LMICs with largest carbon content of proven reserves) in this report

	World Bank acronym	GNI per capita, Atlas method (current USD), 2016*	Oil (incl. NGL)		Natural gas		Coal				Total CO_2 emissions if all remaining reserves extracted & burned under BAU, Gt CO_2
							Anthracite & bituminous		Sub-bituminous & lignite		
			Billion barrels	Gt CO_2 emissions if extracted	Trillion cubic feet	Gt CO_2 emissions if extracted	million tonnes	Gt CO_2 emissions if extracted	million tonnes	Gt CO_2 emissions if extracted	
Angola	AGO	3,450	11.6	4.5	-	-	-	-	-	-	**4.5**
Azerbaijan	AZE	4,760	7.0	2.7	40.6	2.4	-	-	-	-	**5.1**
Bangladesh	BGD	1,330	-	-	7.3	0.4	-	-	-	-	**0.4**
Bolivia	BOL	3,070	-	-	9.9	0.6	-	-	-	-	**0.6**
Chad	TCD	720	1.5	0.6	-	-	-	-	-	-	**0.6**
Egypt	EGY	3,410	3.5	1.4	65.2	3.8	-	-	-	-	**5.2**
India	IND	1,670	4.7	1.8	43.3	2.5	89,782	237.0	4,987	6.7	**248.1**
Indonesia	IDN	3,400	3.3	1.3	101.2	6.0	17,326	45.7	8,247	11.1	**64.0**
Mongolia	MNG	3,590	-	-	-	-	1,170	3.1	1,350	1.8	**4.9**
Myanmar	MMR	1,190	-	-	42.0	2.5	-	-	-	-	**2.5**
Nigeria	NGA	2,450	37.1	14.5	186.6	11.0	-	-	-	-	**25.4**
Pakistan	PAK	1,500	-	-	16.0	0.9	207	0.5	2,857	3.8	**1.5**
Papua New Guinea	PNG	2,680	-	-	7.4	0.4	-	-	-	-	**0.4**
Republic of Congo	COG	1,710	1.6	0.6	-	-	-	-	-	-	**0.6**
South Sudan	SSD	820	3.5	1.4	-	-	-	-	-	-	**1.4**
Sudan	SDN	2,140	1.5	0.6	-	-	-	-	-	-	**0.6**
Tunisia	TUN	3,690	0.4	0.2	-	-	-	-	-	-	**0.2**
Ukraine	UKR	2,310	-	-	20.9	1.2	32,039	84.6	2,336	3.1	**88.9**
Uzbekistan	UZB	2,220	0.6	0.2	38.3	2.3	1,375	3.6	-	-	**6.1**
Vietnam	VNM	2,100	4.4	1.7	21.8	1.3	3,116	8.2	244	0.3	**11.6**
Yemen	YEM	1,040	3.0	1.2	9.4	0.6	-	-	-	-	**1.7**
Zimbabwe	ZWE	890	-	-	-	-	502	1.3	-	-	**1.3**
WORLD			**1,706.7**	**665.6**	**6,588.8**	**387.6**	**816,214**	**2,154.8**	**323,117**	**433.0**	**3,640.94**

Source: Authors' calculations based on World Bank (n.d) and BP (2017). CO_2 conversion factors based on BP (2017), adjusted for non-energy use based on estimates from Heede (2014)

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