



Fanning the Flames: G20 provides record financial support for fossil fuels

Methodology note and reference list

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Purpose

This methodology note and reference list accompanies the digital story *Fanning the Flames: G20 Provides Record Financial Support for Fossil Fuels*. The story brings together the most recent data (at the time of writing) on

- government financial support to fossil fuel production and consumption between 2013 and 2022, namely:
 - subsidies;
 - capital investment by fossil fuel state-owned enterprises (SOEs); and
 - international public finance;
- carbon and excise taxation on fossil fuels;
- government financial commitments for renewable power generation; and
- investment (public and private) in fossil fuels and renewable energy.

The purpose of the methodology note is to provide information on the definition of government support, sources and data used, overarching assumptions, and data gaps.

The digital story builds on a 2020 publication by the International Institute for Sustainable Development (IISD) and partners, *Doubling Back and Doubling Down: G20 Scorecard on Fossil Fuel Funding* (Geddes et al., 2020a), and uses the same methods for estimating fossil fuel support (except for the 2022 fossil fuel subsidy data). Please see the 2020 [Methodology Note](#) for details (Geddes et al. 2020b).

The current methodology note provides sources for all data and any estimation methods that differ from the G20 scorecard, namely

- 2022 fossil fuel subsidies,
- carbon and excise taxes, and
- renewable energy support and investment.

Types of Government Support

Governments support energy production and consumption through different types of public financial flows, concessional tax rates, and foregone revenue, as well as through policies that have an impact on the sector but are difficult to quantify financially (e.g., environmental regulation exemptions).

In the digital story, we aim to bring together data on several key types of government policies that provide financial support to fossil fuels and renewable power. We define and track “government support” as follows (see Table 1 for more details):

- subsidies (e.g., direct budget transfers, tax expenditures, and consumer price support [induced transfers] through regulated below-market prices for consumers);
- public finance (e.g., loans and guarantees) at both market and below-market value; and
- SOE investment (capital expenditure [capex]) at both market and below-market values.

Sources and Methodology

Table 1 provides an overview of the support measures and data sources used in the digital story, which are described in more detail in the following sections.

Table 1. Overview of support measures and data sources covered in the digital story

Data type	Period	Beneficiary	Method, source, and date collected
Fossil fuels			
Subsidies	2017–2021	Producers and consumers of fossil fuels	2017–2021: Fossil Fuel Subsidy Tracker (FFST) (FossilFuelSubsidyTracker.org, n.d.-a, n.d.-c) Data obtained May 16, 2023
	2022	Consumer price-gap support	Based on the G20 share of the International Energy Agency (IEA) 2022 global price-gap estimate (49% in 2021) (see IEA, n.d.-a, n.d.-c)
		Consumer energy crisis (non-price-gap) support	National Fiscal Policy Responses to the Energy Crisis (dataset),(Sgaravetti et al., 2023); Energy Policy Tracker (n.d.); Government Energy Spending Tracker (IEA, 2023b), and Internet searches Data obtained May 2023
		Regular annual consumer (non-price-gap) support,	Estimated as the average of 2019–2021 from the FFST (FossilFuelSubsidyTracker.org, n.d.-a)

Data type	Period	Beneficiary	Method, source, and date collected
		producer and general services	
International public finance	2017-2021	Producers of fossil fuels, including power	Public Finance for Energy Database (n.d.) Data obtained March 2023
	2022	Producers of fossil fuels, including power	Estimated as the average of 2019-2021 (Public Finance for Energy Database, n.d.) Data obtained March 2023
SOE investment	2017-2019	Producers of fossil fuels, including power	<i>Doubling Back and Doubling Down: G20 Scorecard on Fossil Fuel Funding</i> (Geddes et al., 2020a)
	2020-2022	Producers of fossil fuels, including power	Capex data collected by IISD from company annual reports and government reports Data obtained from April to June 2023
Renewable energy			
Subsidy commitments	2020-June 2023	Producers and consumers	Energy Policy Tracker (n.d.), Government Energy Spending Tracker (IEA, 2023); Internet searches (data provided on request) Data obtained June 2023
Investment		Private and public	<i>Global Landscape of Renewable Energy Finance 2023</i> (Climate Policy Initiative [CPI] and International Renewable Energy Agency [IRENA], 2023)
Taxation			
Effective carbon rate	2021	Producers and consumers	<i>Pricing Greenhouse Gas Emissions: Turning Climate Targets Into Climate Action</i> (Organisation for Economic Co-operation and Development [OECD], 2022) <i>Proposal for an International Carbon Price Floor Among Large Emitters</i> (Parry et al., 2021)

Source: Authors' description.

Fossil Fuel Subsidies (2013-2021)

The source of information for subsidies for all countries for the years 2013 to 2021 was the [FFST](#), a data aggregator that draws together the latest subsidy data from the IEA (n.d.-a), International Monetary Fund (IMF, 2022), and OECD (n.d.).² See the “Overarching Data and Assumptions” section below for details on data conversions from nominal to real.

Fossil Fuel Subsidies (2022)

At the time of writing (July 2023), fossil fuel subsidy data was not available in a country-disaggregated format for 2022 from the FFST. The IEA, IMF, and OECD had not yet provided country-disaggregated estimates for 2022. Therefore, we could not use those databases to develop an estimate of G20 subsidies for 2022. Instead, we used several sources and techniques to approximate the likely level of G20 subsidies.

In February 2023, the IEA estimated global fossil fuel price-gap subsidies for 2022 (not disaggregated by country) at USD 1,097 billion (IEA, 2023a). The price-gap method estimates subsidies by taking the difference between a market benchmark price for energy and the price of sale in a given country and multiplying this amount by the volume of sales.

We estimated the share of the IEA’s global estimate that could be attributed to G20 countries. In 2021, the IEA global estimate was for the top 40 price-gap countries, which included seven G20 countries (Argentina, China, India, Indonesia, Mexico, Russia, and Saudi Arabia). Five of those were among the top 10 subsidizers (in order of total subsidies: China, India, Indonesia, Russia, and Saudi Arabia). For 2021, the G20’s share of total IEA price-gap subsidies was 49%. We therefore estimated 2022 subsidies as 49% of the IEA’s 2022 global price-gap estimate of USD 1,097 billion: USD 537 billion.

In developed economies, additional and new assistance was put in place in 2022 in the form of transfers to reduce energy costs such as heating, electricity, and transport fuels. These subsidies would not be captured by the IEA price-gap measures because the IEA does not include developed G20 countries in its analysis. In addition, the majority of the measures would not be captured by a price-gap method in any case because they were applied to fuels that were above international benchmark market prices.

To estimate these subsidies, we gathered data on energy crisis-related affordability measures for all G20 countries not covered by the IEA in their 2021 price-gap estimates. The sources were

- *National Fiscal Policy Responses to the Energy Crisis* (Sgaravatti et al., 2023)
- Government Energy Spending Tracker (IEA, 2023b)
- Internet searches of government websites and reputable media articles.

We endeavoured to only include support that was tied to energy consumption. Social support transfers that were clearly decoupled from energy consumption were excluded, such as cash

² The methodology and definitions of the FFST apply to this work and can be found on its website: <https://fossilfuelsubsidytracker.org/about/>.

transfers that could be used for expenses other than energy. However, the funding mechanism was not clear for all programs, and we were unable to examine each program in detail due to resource constraints. Therefore, there may be some errors of inclusion and exclusion. In some cases, programs were partially allocated as energy programs. For example, British councils were given funds to provide cost-of-living relief to households as they saw fit, including by directly reducing energy bills (Department for Work & Pensions, 2022). In this case, we allocated only a portion of the program to energy.

Energy program funding was allocated to fossil fuels in the following ways:

- For programs where the target fuel was clear (e.g., transport fuels, natural gas), 100% was allocated to fossil fuels.
- For energy programs where the source of energy was not specified, such as heating or industrial uses, funds were allocated in line with the share of fossil fuels in the total primary energy supply (IEA, 2022c).
- For electricity-specific support programs, funds were allocated based on electricity generation capacity in the relevant country (IEA, 2023).

Crisis subsidies were also allocated pro rata to the 2022 calendar year.

We estimated regular, annual consumer (non-price-gap), producer, and general services subsidies for 2022 using the average of 2019–2021 for these subsidy types from the FFST. For consumer subsidies, we assumed that this does not result in double counting because the crisis response measures appear to be different from those listed in the OECD (n.d.) inventory (the source of the FFST data). However, in some cases, the transparency is poor (e.g., policies simply called “relief measures”), and therefore some double counting is possible. However, our overall subsidy estimates are very likely to remain underestimates given that many subsidies are not quantifiable and many subnational measures are not captured.

SOE Investment (2013-2022)

This report uses the information made publicly available by majority government-owned SOEs focused on fossil-based energy through their annual reports from 2017 to 2022. Only national-level SOEs with a 50% or greater share of government ownership are included in this analysis. However, we recognize that some SOEs may have lower government ownership but still be directed by the state. For example, the Italian Ministry of Economy and Finance owns 30% of ENI (the Italian oil and gas company) with a golden share, meaning that the government has veto voting rights. ENI’s second-largest shareholder is an Italian development bank whose largest shareholder is the Italian Ministry of Economy and Finance. However, we were unable to examine these details for all fossil fuel SOEs across G20 countries; therefore, we used the 50% ownership rule and note that the amount of SOE investment is most likely underestimated.

Where annual reports had not yet been published with 2022 data (15 of the 51 SOEs), we used the 2019–2021 average as an estimate for 2022. This is valid because historical data show that SOEs’ capex does not fluctuate dramatically year-on-year.

Data were collected on renewable energy capex when readily available. Renewable energy capex was observed in SOEs in China, India, and France. However, the results are only indicative because not all companies publish disaggregated data on capital investments.

In China, not all energy SOEs' annual reports show how much they have invested in fossil and renewable technologies; some present only gross figures, which makes it impossible to determine from the outside if shifts have happened, for example, from fossil fuels to renewables or in reverse. Transparency is better for companies listed on a stock exchange because they must fulfill certain transparency requirements, including publishing annual reports that contain capex figures and descriptions of how their business is structured.

In our analysis, in several cases, financial data is given only for a Chinese listed subsidiary and not the whole group because the SOE as a whole is not as transparent as its listed subsidiary. Many of China's energy SOEs are conglomerates, and—given the strong economics of renewables—they tend to have some renewable investments mixed in, even if they started out as a company purely focused on fossil fuels. Without specific reporting to separate these investments, it is hard to determine their size and quantify or establish trends. Also, renewable and “new energy” companies are sometimes involved in the fossil fuel business, such as coalbed methane, and transition bonds have been spent on fossil fuels (e.g., “clean” natural gas). Such mixing of renewables and fossil fuels under creative terminologies makes it difficult to draw a clear line and identify precisely how much a company is investing in fossil fuels and renewables.

Fossil Fuel Public Finance, 2013–2022

For all countries, this report uses the information made publicly available by majority government-owned financial institutions. These data can be found in Oil Change International's Public Finance for Energy Database (n.d.). Data on public finance for 2022 was not available at the time of writing (expected in October 2023). Instead, an average of 2019–2021 data has been used to estimate 2022 data.

The Public Finance for Energy Database (n.d.) collects all data on any institution that lends internationally. Some domestic development financial institutions lend internationally as well as domestically. In these cases, the database includes some domestic lending as international lending. This means that most domestic public finance is likely not included, and estimates are therefore highly conservative in nature.

Fossil Fuel Taxation

Like consumer subsidies, the level of taxation on fossil fuels will directly impact prices, influencing consumer and investor decisions. Pricing carbon provides a mechanism to shift consumers and investors to low-carbon alternatives. The digital story provides an indication of how current fossil fuel taxation levels in G20 countries reflect carbon pricing levels suggested by the IMF.

Each country's effective carbon rate (ECR) is used as the taxation measure and is calculated as the sum of explicit carbon taxes, emission trading schemes, and excise taxes (all converted to their carbon dioxide equivalent prices) by the OECD in its *Pricing Greenhouse Gas*

Emissions: Turning Climate Targets Into Climate Action report and database (OECD, 2022). All G20 countries except Saudi Arabia are included in the database.

The carbon price floors are taken from the IMF *Proposal for an International Carbon Price Floor Among Large Emitters* (Parry et al., 2021). The proposal suggests options for carbon price floors and notes the principle of differential treatment for countries based on historical emissions and development status. We use their proposed floor of USD 75, USD 50, and USD 25 for advanced countries, high-income emerging economies,³ and low-income emerging economies,⁴ respectively (World Bank, 2023c).

Potential revenues from lifting current carbon tax levels to the recommended floor were estimated for each country as

the difference between the country's ECR and the relevant carbon tax floor multiplied by annual emissions in 2020 (latest country-disaggregated data available, measured in tonnes of CO₂) from coal, gas, and oil (IEA, 2022).

Emissions in 2020 were lower than in recent years due to the COVID-19 pandemic and associated lockdowns. Therefore, the revenue estimates derived from these emissions are likely to underestimate potential revenues from the same carbon tax increases if they were imposed in 2023.

Renewable Energy Subsidies (2020–2023)

There are no up-to-date databases on G20 or global renewable energy subsidy expenditures. The most recent global estimate of renewable energy subsidies was published in 2020 by IRENA using 2017 data. Subsidies to renewable power generation technologies were estimated to be USD 128 billion in 2017, with the majority (91%) arising from the five largest subsidizing economies (China, the European Union, India, Japan, and the United States) and 9% from the rest of the world (IRENA, 2020).

Estimating G20 renewable energy subsidies was beyond the scope of this project, and instead, we estimated government spending commitments to renewable energy power generation (i.e., solar, wind, tidal, small hydro, and geothermal) using data from energy policy trackers that monitored spending on clean energy in response to the COVID-19 and energy crises. The primary data sources were

- the Energy Policy Tracker (n.d.) (data available to December 2021);
- the IEA (2023b) Government Energy Spending Tracker (data available to November 2022); and
- Internet searches to find additional policies, particularly those announced after November 2022.

These announcements relate to funding committed over the Q2 2020 to Q2 2023 period, and that will be spent over future years (different time periods for each policy). As such, they are

³ Those with a GDP per capita over USD 10,000 in 2021: Argentina, China, and Russia.

⁴ Brazil, Indonesia, India, and South Africa.

not directly comparable to the data on fossil fuel subsidies, SOE capex, or international public finance, which are annual data and relate to actual expenditures (for subsidies and SOE capex) or financing for projects that have closed in the given year. More transparency is needed on actual subsidy expenditures for renewable energy.

Policy Insight on Carbon Capture and Storage and Hydrogen

The Australian subsidy total is based on multiple sources (including Grattan, 2021; IEA, 2022a, 2022b). All sources are available on request from Oil Change International.

Fossil Fuel and Renewable Energy Investment Data

Data were provided by CPI and IRENA from their *Global Landscape of Renewable Energy Finance 2023* (2023). These data represent “primary” financial transactions going into both large- and small-scale projects that directly contribute to the deployment of renewable energy. They therefore exclude secondary transactions—for example, refinancing of existing debts or public trading in financial markets—as these do not represent new investments targeting new renewable energy assets but rather capital being exchanged for existing assets. Moreover, investments are recorded at the time of a project reaching financial close.

Cost of Ending World Hunger

The cost of ending world hunger was derived from Laborde et al. (2020) as the most recent and robust global estimate. Using economic modelling, the study found an additional USD 33 billion in public funding would be required per year until 2030 to end world hunger: USD 14 billion from international donors and USD 19 billion from domestic governments. This was new funding, on top of existing expenditure at the time, and was also assumed to spur an additional USD 52 billion in private investment per year.

Laborde et al. (2020) used baseline data on hunger from 2018, which did not consider the impact of COVID-19, the 2022 energy crisis, and food price inflation arising from Russia's invasion of Ukraine. Adjusting only for annual global inflation, the amount increased to USD 41.5 billion by 2023. Despite these drawbacks, Laborde et al. (2020) remains the best available estimate that uses a comprehensive methodology. For simplicity and transparency, we did not adjust the estimate provided in Laborde et al. (2020), noting that the models would need to be re-run to take into account all recent developments.

The figure of USD 33 billion is similar to others quoted in recent years that are based on less comprehensive methods. In 2021, the World Food Program USA (2022) estimated that providing emergency food supplies for the world's hungry would cost around USD 40 billion annually to 2030. Oxfam (2022) estimated that, as of 2022, donor governments need to invest around USD 37 billion every year until 2030 to tackle extreme and chronic hunger, an estimate partially based on Laborde et al. (2020).

Overarching Data Assumptions

Nominal to real USD: All the USD values were adjusted for inflation and set to real 2022 USD based on the U.S. GDP price deflator, sourced from the World Bank (2013 to 2021) and Economic Research (2022).

Exchange rates: OECD's average annual exchange rates (indicator), obtained in April 2023, were used to convert local currencies to USD.

National and subnational coverage: It must be noted that it is difficult to gather information on subnational support, which means it is likely that some subnational measures have been overlooked. Where possible, the data include measures provided at the national and subnational levels. The OECD inventory of direct budget transfers and tax expenditures (OECD, n.d.), which feeds into the FFST, covers some subnational-level measures. For example, OECD (n.d.) subnational data coverage for the United States only include selected key producer and consumer states (OECD, n.d.). There are also SOEs that exist at the subnational level, including those established by municipal, state, and provincial governments. Investment by these SOEs would have an impact on the level of overall support provided within a G20 country. However, due to the challenges of data access, they are not included in the estimates of SOE investment.

Externalities: The World Trade Organization definition of subsidies we have used does not include externalities arising from the use of fossil fuels, such as the cost of air pollution to health care systems or of climate change. Some argue that quantifying and presenting these costs provides a more accurate picture of the total cost to governments—or the revenue foregone—due to the use of fossil fuels. The IMF (Parry et al., 2020), for example, provides such estimates, which are made up of prices warranted by supply costs, environmental costs, and revenue considerations.

Data Gaps

Transparency of information on all types of government support for fossil fuels and renewables remains limited. Overall, our analysis of reporting demonstrates the significant gap in G20 countries in terms of their reporting on government support.

The study collects data only on national-level subsidy and SOE policies due to the huge resource effort needed to extend data collection to subnational bodies. Subnational jurisdictions can provide large subsidies and include large SOEs. Therefore, it is likely that our findings underestimate the level of government support for fossil fuels in G20 countries across all support measures.

For some of the SOEs included in the analysis, no available data could be found for their capital investment for the entire period considered (e.g., for Argentina's YCRT and Energia Argentina); for others, data were missing for specific years in the period considered. This contributes to a further underestimation of governments' SOE investments.

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Appendix 1. List of Public Finance Institutions Reviewed

Country	Institution
Argentina	YPF, Yacimientos Carboníferos Río Turbio, Energía Argentina (ENARSA/ IEASA)
Australia	Export Finance and Insurance Corporation
Brazil	Brazilian Development Bank
Canada	Export Development Canada, Sustainable Development Technology Canada
China	China Development Bank, Export-Import Bank of China, China Export and Credit Insurance Corporation
France	Proparco
Germany	Euler Hermes, KfW IPEX-Bank, German Investment & Development Corporation, German Investment & Development Corporation, Kreditanstalt für Wiederaufbau
India	Export-Import Bank of India, Power Finance Corporation
Indonesia	Indonesia Eximbank
Italy	Servizi Assicurativi del Commercio Estero
Japan	Japan Bank for International Co-operation, Nippon Export and Investment Insurance, Japan Oil Gas and Metals National Corporation, Japan International Cooperation Agency, Japan Oil Gas and Metals National Corporation, Development Bank of Japan, Japan International Cooperation Agency
Korea	Korea Development Bank, Export-Import Bank of Korea, Korea Trade Insurance Corporation, K-SURE and KEXIM
Mexico	Banco Nacional de Comercio Exterior, Nacional Financiera
Russian Federation	Russian Development Bank

Country	Institution
Saudi Arabia	Saudi Industrial Development Fund, Saudi Fund for Development
South Africa	Development Bank of Southern Africa, Industrial Development Corporation of South Africa
United Kingdom	UK Export FinanceCDC Group Plc
United States	Export-Import Bank of the United States, Overseas Private Investment Corporation

Appendix 2. List of Majority State-Owned Enterprises Reviewed

G20 Country	SOE Name
Argentina	YPF, Yacimientos Carboníferos Río Turbio, Energía Argentina (ENARSA/IEASA), Pampa Energy
Australia	(No national-level energy state-owned enterprises [SOEs])
Brazil	Petrobras
Canada	Trans Mountain Pipeline
China	Sinopec Group (China Petrochemical Corporation), Petro China (CNPC), CNOOC, China Huadian Corporation, China Coal Energy, China Huaneng Group Corporation, China Datang Corporation, China Energy Investment Corp, China Guodian Corporation, Shenhua Group, Dongfang Electric Corporation, State Development & Investment Corporation, Sinochem Group, State Power Investment Corporation, China Resources Power Holding
France	EDF
Germany	(No national-level energy SOEs)
India	ONGC, GAIL, IOCL, BPCL, HPCL, CIL, SCCL, NTPC, BHEL
Indonesia	Pertamina, PTBA, PLN, PGN
Italy	(No national-level energy SOEs)
Japan	(No national-level energy SOEs)
Mexico	Pemex, Comisión Federal de Electricidad (CFE)
Russia	Gazprom, Rosneft, Bashneft
Saudi Arabia	Saudi Aramco, Saudi Electricity Company

G20 Country	SOE Name
South Africa	Petro SA, Transnet, Eskom, AEMFC
Korea	KNOC
Korea	KEPCO, KOGAS, KOCOAL
Turkey	TKI, TTK, EÜAŞ, BOTAŞ, TPAO
United Kingdom	(No national-level energy SOEs)
United States	(No national-level energy SOEs)

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