SDN 2018 Environmental Performance Index—methodology

The Environmental Performance Index (the Index) is produced by scoring the companies included using a series of indicators. These are weighted and aggregated to form a total score between 1 and 0. The Index is relative, so the closer to 1 a company scores, the better its environmental performance *compared with the other companies in the Index*.

This document explains the methodology underpinning the Index. It is split into three main parts. The first part describes the indicator calculations. The second part describes the indicator weightings. The third part describes the data sources used.

One: indicators

The companies included in the Index are those to which either an oil spill or gas flare volume are attributed in NOSDRA's Oil Spill Monitor and Gas Flare Tracker. Each company which spilled oil or flared gas in 2018 is first scored on five indicators, as applicable. These are as follows. The terminology used in the Index is in brackets:

1. Gross quantity of oil spilled, in barrels (quantity spilled).
2. Total number of oil spills (number of spills).
3. Percentage of gross oil spilled which was later removed (oil removed).
4. Volume of gas flared, in mscf (gas flared).
5. Emissions ratio – the quantity of oil spilled and gas flared by a company relative to its oil production volume (emissions ratio).

The calculations for each indicator, and a worked example, are in table one below. All scores are between 0 and 1. They are generated from the range of absolute scores in the data for each indicator.

Table one: indicator calculations and explanations

Indicator 1 – total oil spilled
$$indicator\ score = 1 - \frac{company\ oil\ spill\ total\ (bbl)}{highest\ company\ oil\ spill\ total\ (bbl)}$$ The smaller the total volume of oil spilled, the higher the score will be. The company with the highest total oil spill volume will score 0. Companies that spilled no oil will score 1. Shell had the highest company oil spill total, of 12,131 barrels. A company that spilled 1,000 barrels would therefore receive an indicator score of 0.92:

$$0.92 = 1 - \frac{1{,}000}{12{,}131}$$

Indicator 2 – number of spills

$$indicator\ score = 1 - \frac{number\ of\ company\ oil\ spills}{highest\ number\ of\ company\ spills}$$

The smaller the number of spills, the closer to 1 the indicator score will be. The company with the highest number of spills will score 0. Companies that did not have any spills will score 0.

NAOC has the highest number of spills, 229. A company that had 20 spills would therefore receive an indicator score of 0.91:

$$0.91 = 1 - \frac{20}{229}$$

Indicator 3 – oil removed

$$indicator\ score = \frac{total\ oil\ removed\ per\ company\ (bbl)}{company\ oil\ spill\ total\ (bbl)}$$

The more oil removed from a company's spills, the closer to 1 the indicator will be. A company for which all oil spilled was later removed will receive 1. A company for which no oil was later removed will score 0.

For example, a company for which 100 barrels of oil were removed, of 1,000 barrels spilled in total, would receive an indicator score of 0.10. Note that in the report this figure is presented as a percentage.

$$0.10 = \frac{100}{1000}$$

NB: if a company did not spill any oil, it automatically receives the highest mark possible (1) for this indicator. A company which spilled a large amount of oil, all of which was later recovered, would therefore receive the same score as a company which spilled no oil at all.

This may seem problematic, given that the priority for oil companies should be not to spill oil at all, and that it would not take into account the damage that would still be borne by the environment before the oil was removed (and after, should the environment not be properly remediated).

However, in such a case, the company would also score proportionately worse under indicator

one, which carries a higher weighting than this indicator, partly to account for this issue. It would therefore still score worse overall than a company which spilled no oil.

Indicator 4 – gas flared

$$indicator\ score = 1 - \frac{company\ gas\ flare\ total\ (mscf)}{highest\ company\ gas\ flare\ total\ (mscf)}$$

The smaller the total gas flared, the closer to 1 the indicator score will be. The company with the highest gas flare total will score 0. Companies which flared no gas will score 1.

NNPC flared the most gas, 145,395,765 mscf. A company that flared 10,000,000 mscf would therefore receive an indicator score of 0.93:

$$0.93 = 1 - \frac{10{,}000{,}000}{145{,}395{,}765}$$

Indicator 5 – emissions ratio

$$indicator\ score = 1 - \frac{company\ emissions\ ratio}{highest\ company\ emissions\ ratio}$$

The score for indicator 5 is based on each company's emissions ratio. To calculate the emissions ratio, the combined volume of oil and gas emitted by each company must first be calculated, using the following equation:

$$total\ company\ emissions\ (BOE) = company\ oil\ spill\ total\ (bbl) + company\ gas\ flare\ total\ (BOE)$$

Where

$$company\ gas\ flare\ total\ (BOE) = company\ gas\ flare\ total\ (mscf)\ x\ 0.167$$

This equation uses a conversion factor to make the individual quantities of oil spilled and gas flared directly comparable. We use an industry conversion factor of 1 barrel of oil equivalent (BOE) = 1 mscf of gas flared x 0.167. For a given quantity of gas flared, this gives the number of barrels of oil that would have the equivalent energy value. As oil and gas are often found in the same geological formation, it is common industry practice to calculate a BOE figure in order to compare total hydrocarbon reserves across different resource basins, and so it serves in this Index to estimate total hydrocarbon reserves released into the environment.

According to our Index, a company that spilled 1,000 barrels of oil and flared 5,000,000 mscf of gas would therefore have total emissions of 836,000 BOE:

$$836{,}000 = 1{,}000 + (5{,}000{,}000 \text{ x } 0.167)$$

Once its total emissions have been established, this company's emissions ratio can be calculated, using the following equation:

$$emissions\ ratio = \frac{total\ company\ emissions\ (BOE)}{annual\ company\ oil\ production\ (bbl)}$$

Assuming the company above produced 5,000,000 barrels of oil, it would therefore have an emissions ratio of 0.167, or 16.7%, expressed as a percentage:

$$0.167 = \frac{836{,}000}{5{,}000{,}000}$$

Of the companies included in our Index, Express Petroleum has the highest emission ratio, 828.9%. This is based on it producing 15,762 bbl of oil, spilling 0 barrels, and flaring 782,328 mscf of gas:

$$8.289 = \frac{0 + (782{,}328\ x\ 0.167)}{15{,}762}$$

The indicator score for all other companies can now be calculated, using the first equation provided above:

$$indicator\ score = 1 - \frac{company\ emissions\ ratio}{highest\ company\ emissions\ ratio}$$

So, for example, the same company which spilled 1,000 barrels of oil, flared 5,000,000 mscf of gas, and produced 5,000,000 barrels of oil would receive an indicator score of 0.98:

$$0.98 = 1 - \frac{0.167}{8.289}$$

Two: weightings

A score of between 0 and 1 is generated for each company, for each applicable indicator, using the calculations in the table above. Each indicator is then weighted, aggregated and converted to a *total* score out of 1. This is the basis for the overall Index rankings. As part of the development of the Index, we calculated several versions of our database, based on different weightings, in order to minimise the impact of any one indicator.[1] The final weightings take into account our experience of working with those affected by environmental emissions in the Niger Delta.

75% of the score for each company is derived from its absolute emissions performance (indicators 1 – 4). This is because, regardless of the size of their operations, oil companies should be aiming to reduce potentially harmful emissions to zero. However, it is important to account for the difference in scale of company operations, and so 25% of the score for each company is derived from its relative performance – in other words, its emissions ratio, which is indicator 5.

Within the indicators related to the absolute extent of emissions into the environment (1 – 4), oil indicators (1 - 3) carry twice the weighting of gas (indicator 4): 50% in total. This is because we consider the local impact of an oil spill to be potentially more serious for a local community, and its environment, than being sited near a gas flare. This is based partly on the fact that more evidence is available on the impact of oil spills. Oil, once spilled, is also more likely to remain in the vicinity of a spill, as opposed to gas, which will disperse more widely. Shutting down a gas flare in theory means the end of the local impact (the gas will still contribute to the long-term impact of climate change, of course, and potentially health problems for those living in the area). But the toxic effects of oil will continue until it is removed from a spill site, and the local environment fully remediated.

Within the oil indicators (indicators 1 – 3), the weight for total spill volume (indicator 1) is equal to the combined weights for the number of spills and oil removal rate (indicators 2 and 3). Again, this is because the objective should be to reduce total spill volume to zero. However, the number of spills is important, as it is a proxy for the number of areas potentially affected. 20 small spills may have as great an impact as one spill with the same total volume: for example, because 20 different communities are affected.[2] The oil removal rate means that each company's total net discharge into the environment is also taken into account. As noted in the Index, oil removal may not actually have been undertaken by the company responsible for a spill, but it is nonetheless relevant to understanding its net environmental emissions.

Once weighted, the scores for each indicator are calculated to generate a score out of 1 for each company.

This total score is in comparison with the other companies operating in the region. Only the theoretical high score of 1 (which would mean a company flared no gas and spilled no oil) would imply zero environmental emissions from oil spills and gas flares. However, this would not necessarily mean such a company did not have other emissions and associated

[1] These can be altered by users in the database, which we have published online.
[2] Of course, the size and proximity of human population centres to spill sites is a variable here. These indicators are imperfect, and may be revised in future versions of this Index.

environmental impacts, for example through its operations (such as transport emissions and power for oil infrastructure itself), issues related to water and land management, and methane leakages from infrastructure (which is now recognised as a major source of greenhouse gas emissions).[3]

Non oil-producing companies

Three companies which do not have official production volumes reported in Department for Petroleum Resources (DPR) records nonetheless have oil spills or gas flare volumes attributed to them for 2018. This may be for a number of reasons: for example, because they operated exploratory wells which had not yet proceeded to full production. They are nonetheless included in this analysis because it is intended to compare all companies to which environmental emissions are attributable.

However, because they do not have a production volume, it is not possible to calculate an emissions ratio for these companies. Separate versions of the Index are therefore calculated and included in the database to enable them to be compared with other companies. These exclude the emissions ratio indicator and reweight other indicators proportionately.

Indicator weightings and calculations for all versions of the Index are included in the "Index – criteria" tab of the database.

Three: sources

The oil companies included in the Index are those which either spilled oil or flared gas (or both) in the course of their 2018 operations. We attribute this based on the data in the Nigerian Oil Spill Monitor (OSM) and Gas Flare Tracker (GFT). These tools were developed by SDN for the Nigerian National Oil Spill Detection and Response Agency (NOSDRA).

NOSDRA is an agency of the Federal Ministry of Environment, and its mandate includes monitoring oil industry environmental emissions. DPR provides some information on this topic. However, SDN's longstanding call, made again in this report, is for the separation of regulatory powers between DPR and NOSDRA when it comes to the environment. We therefore use data from NOSDRA, the environmental and not business-focused regulator, as the basis for this research.

Oil spills

Raw data from the OSM was downloaded in October 2019. This was cleaned and standardised to ensure it could be analysed accurately, and other minor changes made to ensure the Index calculates correctly. Otherwise it has not been altered. All changes are indicated in the standardised data used in the database, which is fully reconciled against the source data.

We analysed oil spill records listed in the OSM as "Confirmed" or "Reviewed" by NOSDRA

[3] Eg https://www.edf.org/sites/default/files/documents/EDF_TakingAim.pdf.

staff in the states of Abia, Akwa Ibom, Bayelsa, Edo, Delta, Imo and Rivers, less spills we removed for reasons listed in the database.

To identify major spills that took place which might not have been included in the OSM for any reason, we conducted a Google search of news pages. This was carried out in both standard and incognito mode. We set Google's region to "Nigeria", then used the following Boolean query, adapted for each state included in this report:

Nigeria (Abia AND oil AND spill)
Nigeria (Akwa Ibom AND oil AND spill)
etc.

This search returns only results that include 'Nigeria', the name of the state, and the words 'oil' and spill'.

We filtered the results for each query to those between 01 January 2018 and 31 January 2019, to include spills which may have occurred in December 2018 but been reported in January 2019.

We allowed Google to rank the results by relevance. We then checked and cross-referenced the first two pages of results for each state (140 results in total) against the data in the OSM, based on the location and date of any spill reported in each result, to determine if it had been included or not.

Using this method, at the time of research we had not definitively identified any spills reported in the media which did not appear to have been documented in the OSM.[4] However, we did identify other discrepancies. These are commented on in the box on the Joint Investigation Visit procedure contained in the Index.

Note that some oil companies, and DPR, provide their own statistics on oil spills. These can be lower or higher than the figures in the OSM. As noted previously, we use NOSDRA data, because it is the official relevant public record of detailed oil spill data.

Gas flaring

Raw data from the GFT was downloaded in October 2019 for the months of January – December 2018 inclusive, using the following boundaries: gas flare cluster, states, OMLs / OPLs, onshore/offshore. The data was cleaned and standardised to ensure it could be analysed accurately. The standardised data used in the database is fully reconciled against the source data. Note that there are some discrepancies in total figures provided by the GFT depending on how flare volumes are selected. This is because of the interaction between visual boundaries on the GFT and spatial inaccuracies of the satellite instruments used to calculate flare locations.

We attributed flare volumes to individual companies based on DPR's *Nigerian Oil and Gas Industry Annual Report 2018* (NOGIAR) data on field status and operatorship, as described

[4] This does not mean that there were no other spills, however, only that they were not reported; logistical and security issues mean access to many parts of the Niger Delta is difficult.

in the database. For marginal fields, we used individual flare site (cluster) data, and then cross-referenced the location of each with the locations of marginal fields as presented in the map included in NOGIAR, supplemented with other sources. These and the map are included in the database.

This cross-referencing was done using visual corroboration, which is by its nature imperfect. However, in most cases there is only a single flare stack in one clearly identifiable area, so there should be little room for error. We welcome further information on marginal fields and other gas flare concessions.

Oil block licence ownership

Oil concession data is from NOGIAR 2018. The relevant tables are reproduced in the database.

Oil company production volumes

Oil company production volumes are taken from NOGIAR 2018, if a figure is available, and if not then from the DPR *Annual Statistical Bulletin 2018* (ASB), if a figure is available there. The NOGIAR figures are preferred, as this is a later document. However, companies which have production volumes listed in the ASB but not NOGIAR are still included in the Index.

It is assumed that companies which do not feature in either NOGIAR or the ASB did not produce any oil in 2018. However, if they have oil spills or gas flaring attributed to them in the NOSDRA datasets then they are still included in the Index, as its purpose is to evaluate environmental emissions performance, and this can still be done absent a production volume, as described in the section on weightings.

Four: references

Specific URLs, page references and other source and explanatory notes are included in the report and database as necessary.

Disclaimer

The analysis in this report is indicative and based on publicly available data. The Index, the database on which it is based and this Index methodology, which we have published online, were independently reviewed by relevant peer organisations, and are based on good-faith assumptions and calculations. We wrote to companies included in the Index with a copy of the draft report prior to publication, and organised an event in Lagos with their representatives to receive feedback on this work. This process is described and discussed in the Annex we have included in the Index. We welcome new data and information on environmental emissions in the Niger Delta. We also welcome suggestions for how this work could be improved. We will aim to update our analysis in future versions of the Index accordingly.