Sixty years of gas flaring in Nigeria – science and policy

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Abstract

Pollution from gas flaring is an urgent problem in some parts of the world. This is especially the case in Nigeria where associated gas has been flared for 60 years. Nigeria contains the largest natural gas reserves in Africa and produces more oil than any other country in Africa. Nigeria also ranks as the fourth-largest gas-flaring nation in the world. The petroleum sector in Nigeria contributes a large portion of greenhouse gases released into the atmosphere, in Nigeria. Several studies have discovered deleterious impact of gas flaring on ecosystems of host communities. By now, gas flaring should be considered as vestige from the past, because the technology exist to control it. However, gas utilization projects have become more common in Nigeria, they provide hope for the cessation of gas flaring. Gas flaring is continually getting more attention in intergovernmental organizations. The World Bank aims to end routine gas flaring at oil production sites in the world by 2030. Governments, oil companies, and development institutions around the world are encouraged by the World Bank to endorse the “Zero Routine Flaring by 2030” Initiative.

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Introduction

The flaring of associated gas is regarded as one of the most challenging problems in today's world: an energy and environmental problem (Farina, 2010). Gas flaring has been a perennial issue in Nigeria, since oil production began, 60 years ago, from the first successful oil well in Oloibiri community of Bayelsa State, in 1956. A major oil and gas producing country: Nigeria contains the largest natural gas reserves in Africa and produces more oil than any other country in Africa. Nigeria was also the world's fourth-largest exporter of liquefied natural gas (LNG) in 2015 (BP, 2015). Nigeria became a member of the Organization of the Petroleum Exporting Countries (OPEC) in 1971, 15 years after oil production commenced (OPEC, 2016). Gas flaring is the predominant source of the 90 Mt of CO_2 per annum produced in Nigeria, making the petroleum sector in Nigeria one of the main sources of greenhouse gas emissions (Federal Ministry of Environment, 2015).

Tollefson (2016), revealed that gas-flaring data provided by the U.S. National Aeronautic and Space Administration Agency (NASA) weather satellite, showed that 3.5 percent of the world's natural-gas supply was wastefully burned, or flared at oil and gas fields in 2012. The United States of America has the most *number* of flares, but Russia has the largest *volume* of flared natural gas in the world. Nigeria ranks as the fourth largest gas-flaring country, behind Russia, Iran and Iraq. The gas-flaring estimates provided by NASA related only to 2012 activity, estimates for later years are yet to be published.

Gas flaring is continually getting more attention in intergovernmental organizations. The World Bank (2016b) aims to end routine gas flaring at oil production sites in the world by 2030. Governments, oil companies, and development institutions around the world are encouraged by the World Bank to endorse the "Zero Routine Flaring by 2030" Initiative. In a related development, the World Bank, in April 2016 also reported a "fundamental shift": a refocusing of its financing efforts towards tackling climate change, will be part of its strategy for alleviating poverty. The World Bank (the number one provider of public finance to developing countries), will now spend 28 percent of its investments directly on climate change projects (World Bank, 2016a).

From now on, all of the World Bank's future spending will take account of global warming. At least $16 billion a year from across the World Bank group (which includes other development and finance institutions), will be directed to climate change projects. The World Bank, in 2002, commenced a public-private partnership initiative called Global Gas Flaring Reduction (GGFR). Partners signed up to GGFR included Algeria, Angola, Azerbaijan, Cameroon, Chad, Ecuador, Equatorial Guinea, Gabon, Indonesia, Iraq, Kazakhstan, Russia, Mexico, Nigeria, Qatar, United Arab Emirates and Uzbekistan. GGFR signed up 19 oil and gas companies including BP, Shell, Chevron, ConocoPhillips, and ExxonMobil. Donor countries to GGFR included the United States of America, the United Kingdom, France, Norway and Canada. The European Union, the Organization of Petroleum Exporting Countries also signed up to GGFR (Buzcu-Guven *et al.*, 2010).

The United Nations Framework Convention on Climate Change (UNFCCC, 2015), achieved an international breakthrough with the Paris Agreement of December 2015. For the Paris Agreement, countries had to submit national plans (for 2020 and beyond)

that address the climate change challenge.

In its 31 March 2016 editorial, the Nigeria's Guardian newspaper (The Guardian, 2016), stated that Nigeria accounts for 12.5 percent of total global gas flaring value. As far back as 1969, the Federal Government of Nigeria directed all oil companies operating in Nigeria to end gas flaring within five years, by taking steps to utilize the gas. This directive was ignored and continued gas flaring provoked the Nigerian government to establish the Associated Gas Reinjection Act of 1979 into being. The international oil companies (IOCs) found it more convenient to pay fines, as a penalty for gas flaring. In 2005, a Federal High Court in Nigeria ruled that gas flaring is a violation of the human rights of residents in the affected neighbouring communities. But, in 2009, the Shell Petroleum Development Company (SPDC), operating Nigeria, reported that more than $3 billion of additional investment was needed to reduce gas flaring in Nigeria to a reasonable level.

Pollution Impacts

Historically, natural gas produced during oil production has been burnt off. This *associated* gas was always regarded as a waste or by-product formed during the extraction of oil from a reservoir. The burning of natural gas in oil production sites was deemed the most efficient solution, as the incentive to invest in expensive gas-capture infrastructure was absent. Gas flaring is still the more acceptable option compared to venting methane, butane or propane (produced during oil production) directly into the atmosphere. Methane is estimated to have 25 times the global warming impact of carbon dioxide (Tollefson, 2013). Gas *flaring* has deleterious effects on local air quality and contributes to global warming, but outright gas *venting* is more dangerous.

It has been discovered that associated gas flaring, in Nigeria, raises the level of carbon dioxide, nitrogen oxides, sulphur oxides and particulates in the atmosphere (Nwanya, 2011). It was believed that gas flaring produced only non-toxic carbon dioxide and water, due to the high flaring efficiency (Anejionu *et al*., 2015). But, during the flaring of associated gas, combustion is not always complete: toxic by-products like hydrogen sulphide and volatile organic compounds (VOCs) are commonly emitted. The oxidation of gases produces secondary organic aerosol (SOA) mass, new compounds are produced that nucleate or condense into old compounds (Liggio *et al*., 2016).

According to the Organisation for Economic Co-operation and Development (OECD, 2012), particulates in the air cause the death of 1.5 million people every year. This annual mortality is more than those occurring due to lack of clean water or malaria disease. In the developing world, there is greater concern: in urban areas, poor health services and high population density make people there particularly vulnerable.

In Nigeria, poor and reduced yields of agricultural crops, reduced flowering of plants, acidification of soils and rainwater (acid rain) with corrosion of metal roofs have been reported (Ismail and Umokoro, 2012). In addition, Ismail and Umkoro (2012), also reported deformities in children, skin problems and damage to the lungs of residents of the communities affected by gas flaring.

Odujo and Osemwenhae (2009) produced evidence of reduced maize yield in a community affected by gas flaring, using the Ovade gas flare site in Edo State, Nigeria, as a case study. Maize yield was reduced by 76.4 percent, 70.2 percent and 58.2 percent at 500 metres, 1 kilometre and 2 kilometres from the gas flare site. Within two kilometres from the gas flare site, maize cultivation was not economically viable.

Gobo *et al.* (2009) investigated the medical records of the people resident in Igwuruta and Umuchen communities, exposed to the impacts of gas flaring, in Rivers State, Nigeria. These records were compared with those of residents in a control site, Ayama community, also in Rivers State. More frequent cases of asthma, coughs, breathing difficulties, eye and skin irritation were discovered in the communities exposed to gas flaring. These illnesses accounted for about 25 percent of all recorded cases, in communities exposed to gas flaring, compared with these illnesses constituting only 5.9 percent in the communities unexposed to gas flaring.

Adienbo and Nwafor (2010) concluded that prolonged exposure to associated gas flaring caused significant deterioration in human haematological parameters. Venous samples of people residing in gas-flaring environments were compared with samples of people residing in non-gas flaring environments. Results revealed that the packed cell volume (PCV), haemoglobin (Hb) and red blood cells (RBC) count of subjects exposed to gas flaring were markedly reduced.

Pyagbara (2007) states that the people of Ogoni community in Rivers State, Nigeria have suffered from light pollution – as a result of constant gas flaring in the area. This form of pollution affects diurnality, alters night-time patterns in organisms and affects the reproduction of fish.

Conclusion

Gas flaring in Nigeria has resulted in 60 years of pollution, mostly preventable. It is an urgent problem. The technology exists, today, to address the issue. Gas-gathering/utilization projects resulting in liquefied natural gas (LNG), is one viable solution. Enhanced oil recovery (EOR)/gas-reinjection projects, micro gas-to-liquids (GTL) plants are other options. These projects would turn waste to wealth, while helping to reduce the pollution impacts of gas flaring on ecosystems in Nigeria.

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