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The Evolving International Gas Market and Energy Security in Nigeria

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Introduction

This chapter examines the regulatory and institutional dimensions of energy security in Nigeria in the context of an evolving international gas supply market and ongoing domestic petroleum (gas) industry reforms. The global gas market comprises regional markets often grouped based on either the historical patterns of transoceanic shipping, that is, the Atlantic and Pacific Basins, or the primary supra-regions for natural gas trade, that is, North America, Europe, and Asia (Leidos, Inc., for US Energy Information Administration [EIA] 2014; Rogers 2012). The regional and domestic markets have become increasingly international and interconnected mainly due to developments in the liquefied natural gas (LNG) industry and expansion in intraregional gas demand and sup-

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ply mostly within North America, Russia, and Europe, as well as the Asia-Pacific region (BP 2018, pp. 80–83; IEA 2016a, 2017; Rogers 2012). These major markets are served by a capital-intensive network of local and cross-border pipelines, and gas processing and storage facilities. The key stakeholders along the energy value chain for gas supply typically include international and local corporations engaged in production and supply ventures, consumers, and governmental agencies or regulators (Oyewunmi 2018, pp. 14–28; Roggenkamp et al. 2012, pp. 1–10, 413–436; United States Agency for International Development [USAID] 2016; De Vita et al. 2016).

Remarkably, several countries such as Nigeria, Mexico, China, and Egypt are pursuing gas and energy market reforms that are expected to foster private-sector participation and competitiveness, as well as secure more investments across the supply chain. While these market organisation and structural changes occur, recent trends portend more competition for market share and capital investments following developments such as the US shale gas production boom, commercialisation projects in Australia, and significant discoveries in many frontier regions. Given the dictates of behavioural economics and financing in relation to 'risk aversion', in that 'the pain of losing is often considered as greater than the pleasure of winning', especially in a capital-intensive sector like gas supply, countries characterised by regulatory uncertainties and institutional inefficiencies or perceived as high-risk environments are susceptible to 'investment freeze' or avoidance and mothballing by operators, investors, and project developers (Posner 2013; Hu 1990; Bermudez and Pardo 2015). In the evolving contexts of limited capital, dynamic and international market developments, as well as the peculiar attributes of gas and energy which makes it difficult to store and requiring contstant balancing of demand and supply, investors and operators would primarily seek markets with creditworthy buyers and guaranteed reasonable returns on investments. To support firm investment decisions in this regard, the regulatory and institutional aspects of the business environment should foster the liquidity of markets, creditworthiness of buyers as well as reasonable returns on investments. Lack of timely investment decisions in the commercialisation of either associated or non-associated gas, as well as the affiliated supply networks, has security of supply implications, especially

in energy markets with an inadequate or unreliable infrastructure (Oyewunmi 2017b, 2018). To be comepetitive, domestic gas markets must develop the necessary organisational institutions—laws, policies, judicial and quasi-judicial decision-makers, independent economic regulators or agencies, and contracts—that can facilitate better adaptation to the demands of the evolving international gas market.

In this chapter, 'energy security' is examined from a 'security of supply' perspective that comprises the legal and institutional condition(s) for safeguarding the reliable access and supply of gas to operating firms, consumers, and stakeholders at reasonable costs, while the risk(s) of significant disruptions are eliminated or adequately mitigated (Oyewunmi 2015a, 2018; Joskow 2007; Von Hirschhausen 2008; Cameron 2007). Given the importance of a reliable and 'secure' gas supply for power generation in the global gas market context, this chapter aims to address the following questions: (i) What are the key institutional features of the typical gas supply to the power industry? (ii) What are the evolving trends and outlook for the international and Nigerian gas supply to the power industry? and (iii) From a law and policy perspective, what are the energy security implications of the trends and outlook for relevant operators, consumers, and stakeholders in Nigeria? Section "The Gas Supply Value Chain" discusses the various elements of the typical gas supply industry, including the nexus between energy security and competitiveness; section "International Gas Markets and Nigeria" examines the evolving international gas markets and the Nigerian scenario; section "Nigerian Gas Supply Industry and Energy Security" focuses on the institutional issues in Nigeria and how they relate to addressing the security of energy supply issues; and section "Conclusion" concludes the chapter.

The Gas Supply Value Chain

The drive towards global gas commercialisation and supply can be attributed to (i) the low-carbon nature of gas compared with other hydrocarbons, such as coal and diesel; (ii) its cost-efficiency and the development of gas-fired power generation technologies, such as combined cycle power

plants (CCPPs); (iii) advancements in shipping and long-distance cross-border pipelines enabling access to significant demand centres and remote areas; and (iv) the emergence of the more flexible and competitive LNG supply industry (Sakmar 2015; Stern and Rogers 2011). Another relevant factor has been the liberalisation of the US gas market during the 1980s–1990s, followed by the application of similar paradigms of competition-based gas supply market governance and organisation in the UK and Western Europe, which has led to the increasing commoditisation of gas and more competitive markets (Oyewunmi 2017a). Gas production, processing, storage, and supply is capital intensive and requires a considerable level of technical and operational expertise and system balancing when considered in the context of gas-to-power networks. The physical features of gas, which make it challenging to store, presupposes that investment decisions on production, processing, and supply should take due cognisance of viable demand centres and creditworthy buyers or markets *ex ante*. Thus, adequate and timely investments in production and supply, as well as efficient project planning and management, are critical to energy security, especially in countries such as Nigeria where about 80% of installed electricity generation capacity relies on the gas supply (IEA 2014; World Bank 2004; Santley et al. 2014).

To understand the institutional dynamics of the gas supply industry, it is essential to highlight the legal and contractual nature of property rights and licences, which empowers relevant operators to find, produce, take away, process, and sell gas resources. Historically, upstream petroleum licensing and contracts were tailored towards crude oil exploration and production (E&P), while natural gas discovered in the process (especially associated gas) is often flared, vented, or used in enhanced oil recovery operations. Countries with commercial quantities of natural gas gradually began awarding upstream petroleum rights, licences, or contracts bordering on gas utilisation due to the emergence of significant demand centres and the growth in gas-fired power generation globally (Smith et al. 2010, pp. 1028–1030). The gas supply chain comprises (i) the upstream E&P; (ii) the midstream gas (processing, storage, and transmission); and (iii) the downstream (sales and distribution) segments. The upstream producers hold a licence to explore and produce gas, which is then gathered through small diameter pipelines (gathering lines) from oil

and/or gas fields; the gas molecules thereafter go through the processing facilities to remove water and impurities. The gas is compressed to boost its pressure and enable it to flow into large transmission pipelines midstream, which are owned and operated by gas pipeline firms, and then transported to storage, distribution, or marketing centres in the downstream segment (Oyewunmi 2018, 2017b; USAID 2016; Eisen et al. 2015, pp. 539–544).

Upstream Licensing and Contracts

In the US, there is an established framework of absolute or qualified private ownership of oil and gas resources, while in most other countries, the ownership and property rights in oil and gas are vested in the State and managed based on the relevant institutional, legal, and regulatory framework (Aladeitan 2012; Kramer and Anderson 2005). The highly technical and capital-intensive nature of E&P operations connote that governments vested with the property rights would typically engage international oil companies (IOCs) and other private independents as partners, co-venturers, or contractors to develop these resources. In addition, resource-rich countries typically establish national oil companies (NOCs) as the State's commercial participation vehicle in E&P operations (Ledesma 2009). The main forms of international upstream licensing and contractual arrangements include licences and concessions; joint ventures/joint operating agreement (JV/JOA); production sharing contracts (PSCs); and service contracts (i.e., risk service contract [RSC] and pure service contracts) (Naseem and Naseem 2014; Oyewunmi 2018, 2015b; Omorogbe 2003).

(a) **Licences and Concessions**

Old E&P concessions (pre-1960) involved the host government transferring absolute control and ownership of vast areas of land and hydrocarbons within its territorial jurisdiction to IOCs for very lengthy durations, such as 70–90 years. The State was then compensated with payments of royalty and rents, while the IOCs bore all attendant risks and rewards (Smith et al. 2010). Following the formation of the Organization of the

Petroleum Exporting Countries (OPEC) in 1960, and events such as the UN Declaration of Permanent Sovereignty over Natural Resources, 1962 (resolution 1803 (XVII)), OPEC resolution XVI 90 1968, and the New International Economic Order, UN Resolution 3201 of 1974, the major petroleum-producing countries began to participate directly in E&P operations, among other things, with the aim of maximising economic benefits in petroleum resources (Cuervo 2008). Consequently, newer forms of licensing and concessions were introduced, such as Nigeria's oil prospecting licence (OPL) and oil mining lease (OML).[1] Several host governments established NOCs, such as the Nigerian National Petroleum Corporation (NNPC),[2] with the aim of coordinating the State's participation in the industry. Thus, the NOCs could execute JV/JOAs with the IOCs, that is, the former concession holders.

The JV comprises the participation agreement, which defines the relationship and participating interests of the parties, while the JOA defines the legal and operational relationship of the joint venturers by providing for issues such as the operator of the concession, the operating committee, work programme and budget, development or disposition of discovered gas, transfer of participating interests, and so on (Smith et al. 2010). Under the modern concessions and licensing, the State maintains sovereignty over its territory, while incurring capital, commercial, and operational E&P obligations corresponding to the portion of participating interests held by the NOC and as defined in the relevant JV/JOA framework. The IOCs and private companies, on the other hand, are co-venturers with the right to find, produce, and take away oil and gas based on the JV/JOA framework and subject to payment of required royalties and taxes, as provided by the relevant petroleum law(s) of the host country. Due to the considerable capital and technical risk(s) exposure under the licensing or JV/JOA framework, most developing countries now prefer alternative contractual arrangements, such as the PSCs and service contracts.

(b) **PSCs and Service Contracts**

A PSC is essentially an agreement in which the State holds the licence or lease and appoints the IOC or private E&P company as a contractor to carry out upstream operations. Under the PSC arrangement, the parties agree to share produced oil and gas from the defined contract area

in predetermined percentages, following the allocation and payment of relevant tax, royalties, and fees, usually in kind (Smith et al. 2010). The contractor bears all the E&P risks and is generally in charge of operations and the management of the contract area, unless the State party agrees to participate in the venture directly. If no petroleum is found, the contractor typically receives no compensation. By and large, the duration of the E&P period, the evaluation and announcement of a commercial discovery, developing a feasible gas utilisation project, and deciding which party will be primarily responsible for marketing are vital elements relating to gas supply arrangements (Oyewunmi 2015b, 2018).

For instance, in Nigeria, the Petroleum (Drilling and Production) Regulations 1969 ('D&P Regulations') provides that an OPL holder may submit a feasibility study programme or proposal for gas utilisation within five years of the commencement of crude oil production. The Federal Government is empowered under the Petroleum Act (PA) to take produced gas free of charge or at a price without payment of royalty, as well as to approve the price for domestic gas sales. The provisions of the Nigerian Model PSC used in 2005 suggest that more attention is being accorded to gas commercialisation, seemingly in line with the global trend of the 2000s. The 2005 Nigerian Model PSC provides inter alia that when the contractor discovers sufficient gas quantities that could justify commercial development, it shall report the same to the NNPC. The contractor shall investigate and submit proposals for the commercial development while considering local strategic needs to be identified by the NNPC. Both the contractor and NNPC would also execute further gas development agreement(s) that shall recognise the former's right to participate in development projects, the right to recover costs and share in profits. The contractor is also obliged to submit a field development programme to the NNPC.[3]

Likewise, in Tanzania, Article 15 of the 2013 Model Production Sharing Agreement adopted by the Tanzania Petroleum Development Corporation (TPDC) enjoins a contractor who has informed the TPDC of potential commercial interest in discovered natural gas to submit proposals for an appraisal programme within 30 days.[4] Following an approved appraisal programme, the TPDC and the contractor shall execute other agreements on the development, production, processing, and sale of such gas. Such further agreements shall be negotiated in good faith and ensure recovery of all expenses and costs incurred as well as a reasonable return on investments.

Under an RSC, the contractor bears the entire E&P capital and investment risk, while the State retains title to and ownership of the acreage and hydrocarbon in situ. Where the contractor fails to make a commercial discovery, the contract is terminated, with no obligation on either side, but where a commercial discovery is made, the contractor is paid in cash or kind (Smith et al. 2010; Naseem and Naseem 2014). Under a pure service contract, the capital and investment risks are borne primarily by the State, while the contractor is paid a flat fee for its E&P technical services and work carried out. Thus, the contractor is simply a technical service provider working under the State's supervision and has no legal or beneficial interest in the oil and gas resources. Under a technical assistance agreement framework, the IOC or private company is engaged by the host government to provide technical services and technology transfer (Smith et al. 2010). Notably, the RSC and the pure service contracts are common in Latin America and the Middle Eastern countries. Likewise, the PSC, hybrids, and model host government agreements are now more common amongst developing countries, due to the benefits of helping to facilitate the realisation of the underlying objectives of both State and private parties in the most standardised and efficient manner. The Association of International Petroleum Negotiator's (AIPN) suite of model contracts is also commonly adopted in international oil and gas transactions.

In Nigeria, the ownership, property in, and control of all oil and gas resources are vested in the Federal Government, headed by the President. The property and ownership rights are to be administered based on the Laws of the Federation.[5] The PA and D&P regulations constitute the primary legal and regulatory framework for the oil and gas industry (Omorogbe 2003). Through the NNPC, the Federal Government participates and holds majority interests in upstream oil and gas commercial arrangements. The Minister of Petroleum ('Minister') carries out his or her statutory governance and supervisory role as head of the Ministry of Petroleum Resources ('Ministry'), which also includes the Department of Petroleum Resources (DPR) as the industry's primary regulator. The Minister, whose office is part and parcel of the Presidency, and in some cases is actually the President himself where no Minister is appointed, also chairs the board of NNPC in accordance with the NNPC Act. The licensing and regulation of gas supply and pipeline networks is under the

purview of the Minister, as stipulated under the Oil Pipelines Act 1956 and the Oil Pipelines Regulations 1995 (the 'Pipelines Regulation') (Oyewunmi 2014; Omorogbe 2003).[6] Until 1992–1993, almost all of Nigeria's upstream operations were carried out under the JV/JOA arrangements between the NNPC and the IOCs or other Nigerian-owned or foreign independents. Since the 1990s, there have been more operations performed through PSCs, while several marginal field licences and sole risk concessions have been issued to indigenous operators (Oyewunmi 2018; Omorogbe 2003).

Centralised and Decentralised Gas Supply Chains

The supply of gas for energy purposes, whether in the form of LNG imported from a gas-producing country or as associated or non-associated gas produced, processed, and transported within a national domestic market, can be carried out in the context of a centralised State-controlled value chain or via a largely decentralised network in which a liberalised and competition-based market structure exists (Peng and Poudineh 2015). From the E&P wellhead to final consumers or large-scale buyers (such as gas-fired electricity generators), the network-bound and natural monopoly nature of the gas supply industry often leads to the development of vertically integrated monopolies or oligopolies, which in some cases have monopsony attributes (Oyewunmi 2018). Such corporations have property and/or commercial interests in gas resources upstream as well as a transmission subsidiary to manage and operate their supply pipelines and ancillary infrastructure. While the actual market structures that exist in the respective countries are mostly hybrids, in a centralised value chain, there is a State-owned or controlled, vertically integrated utility. Such a State-owned or controlled utility is often a subsidiary of the NOC. The utility or gas transportation subsidiary of the NOC owns and operates the entire or most of the domestic gas supply infrastructure within a vertically integrated corporate structure. For instance, the Nigerian Gas Company Limited (NGC) (recently renamed the Nigerian Gas Processing and Transportation Company Limited [NGPTC]) is the NNPC's subsidiary that currently owns and operates the bulk of the

domestic transmission and marketing pipeline network in Nigeria.[7] Such centralised gas supply and public utility-styled corporations also existed in countries such as the UK and other EU Member States before the implementation of the US model of liberalisation and economic regulation initiatives which began in the 1990s (Haase and Bressers 2010; Stern and Rogers 2014; Talus 2016).

The decentralised gas supply market archetype is characterised by pro-liberalisation policies such as (i) mandatory or negotiated third-party access (TPA) to the essential supply network of pipelines and supply facilities once controlled or owned by the State-owned utility or private corporations operating as vertically integrated monopolies; (ii) unbundling of network ownership and operation from gas production and sales; (iii) the establishment of an independent economic regulator to efficiently regulate pricing and market access, where natural monopolies exist; and (iv) the emergence of hub markets such as the Henry Hub in the US and the National Balancing Point (NBP) in the UK (Oyewunmi 2017a; Peng and Poudineh 2015). In this regard, a gas producer can execute a purchase and supply agreement with an end-user, such as the operator of a CCPP, and agree on transportation terms with the 'unbundled' pipeline owner or network operating firm, subject to the relevant open access or TPA framework.

Thus, the decentralised paradigms involve multiple private interest holders and corporate participants engaged in non-network segments, such as gas production, import and export, gas storage, sales, and marketing. In such contexts, the transmission and distribution networks could be owned or operated by regulated monopolies, or independent transmission or system operators (Roggenkamp 1997). The primary economic rationale for the competition-based paradigm of decentralised markets is to curtail the propensity of a vertically integrated utility, which may have supply monopoly and upstream monopsony powers to discriminate against customers and third parties. Due to accumulated market power and the absence of competition in the typical centralised contexts, there is also the risk of inadequate commercial motivation to invest efficiently in existing or additional supply infrastructures (Von Hirschhausen 2008; Joskow 1996). Additionally, investment or resource allocation decisions under a centralised or state-controlled framework fraught with regulatory uncertainties and inefficiencies is arguably more susceptible to non-

commercial factors such as socio-political considerations, corruption, and bureaucratic bottlenecks, especially in the absence of reasonable and fair competition.

By applying economic regulation and/or antitrust principles, liberalisation should allows multiple producers to gain access to pipelines and supply networks on reasonable, cost-reflective, and non-discriminatory terms, in other words, to sell their volumes on market-led terms, while transmission and system operators are created out of the erstwhile vertically integrated utilities (Baldwin et al. 2012; Spence 2007–2008). Consequently, entry, pricing, and resource allocation in the competitive segments are progressively deregulated, while transmission or distribution network owners are mandated to make their assets available to third parties on non-discriminatory, just, and reasonable terms. An independent economic regulator is also created to ensure accountability, just and efficient, competition-based market interaction. In both the centralised and decentralised archetypes, the role of regulation via formal and organisational institutions is pivotal and can be considered as providing the facilitative means towards realising the policy objectives of competitiveness, security of supply, or sustainability (Oyewunmi 2017a).

Supply Contracts and Organisation

Gas supply arrangements are consolidated following the execution of agreements such as a Gas Supply and Purchase Agreement (GSPA) and Gas Transportation Agreement (GTA). A GSPA or a gas sales agreement between the upstream producer and the supply utility or the pipeline network company aims at securing the former's commitment to sell and the latter's commitment to buy designated quantities of gas to be produced, subject to a predetermined pricing and rate-of-return framework. In some cases, the purchaser, that is, the pipeline network company could be the end-user of the gas in cases where such company also owns or operates a CCPP for gas-fired power generation. Otherwise, the gas purchased is meant for another end-user, such as independent power producers (IPPs), industrial users, and local distributors, or export via LNG facilities and cross-border pipelines. The GTA covers

the relevant terms such as transportation tariffs and ancillary service obligations by a pipeline owner and operator for transporting the gas (Oyewunmi 2017b, 2018; Roberts and Maalouf 2014). Traditionally, the agreements have a long-term duration, for example, 20–30 years, with 'creditworthy' buyers and transmission service users; although trends in more competitive markets with the liquidity and financing risks mitigation tools such as in the US and UK trading hubs potray the development of supply contracts with shorter terms. Other significant provisions of these arrangements include a take-or-pay (ToP) clause, a deliver-or-pay (DoP) clause, pricing and price reviews, and destination clauses (Smith et al. 2010).

Concluding relevant terms and the viability of the demand market or buyer's ability to pay is essential to financing and making a final investment decision (FID) on commercialisation projects. Financiers and contracting parties are unlikely to shoulder the significant capital and investments required for these projects, which have long payback periods and involve highly technical and operational requirements, without reasonably firm long-term commitments and efficient risk-allocation mechanisms. In an energy supply context, a long-term contractual framework is often adopted as a tool for ensuring security of demand and security of supply. Generally, it is believed that investments in large-scale, capital-intensive gas processing and transportation facilities or infrastructure will be unfeasible for upstream producers and suppliers without such 'long-term' arrangements in which the terms or production, supply, and purchase are explicitly agreed and supported by a coherent legal and regulatory framework. Nevertheless, the adoption of modern risk-sharing and mitigation contracting tools and market formations that have emerged with liberalisation and short-term hub-based market arrangements in countries such as the US or Western Europe have shown that such risks can be mitigated, so long as functional and efficient institutions are established to provide the required commercial safeguards.

It is worth noting that in the US, the development of competitive gas supply hub trading and spot markets went hand in hand with the creation of a viable natural gas futures market on the New York Mercantile Exchange (NYMEX), which enabled gas buyers and sellers to hedge their price risks and reduce exposure to price volatility (Von Hirschhausen 2008; Eisen et al. 2015). The availability of such financial instruments helped large gas

users insure their operations against losses from price volatility attributable to spot-market and short-term arrangements. However, the California energy crisis of 2000–2001 and the Enron Collapse of 2001 are pointers to the severe security of supply problems that could arise even in deregulated markets. In the absence of effective independent economic regulation, which enhances accountability and rule of law, such deregulated markets are equally susceptible to manipulation, opportunism, and rent seeking (Weaver 2004). The development of the competitive gas market in the US in the 1980s–1990s was gradual. The process benefited from an existing and vast network of gas supply infrastructure, as well as strong financial, judicial, and quasi-judicial institutions, and a functional independent regulator, that is, the Federal Energy Regulatory Commission (FERC) (Oyewunmi 2017a). Thus, developing countries such as Nigeria seeking to restructure and develop such competitive and secure markets should note the relevance of underlying institutional factors.

Energy Security and Competitive Gas Supply

Long-term energy security requires timely investments to supply energy in line with economic development and sustainable environmental needs (Barton et al. 2004). Short-term energy security focuses on the ability of the energy system to react promptly to sudden changes in the supply-demand balance (Oyewunmi 2015a). Lack of energy security may, therefore, involve the negative economic and social impacts of either physical unavailability of energy, power outages, and supply disruptions, or prices that are not competitive, unaffordable, or overly volatile. Operators and investors in all commercial ventures, including capital-intensive energy supply, often value the 'risk of losses' more highly than the equivalent 'risk to gains'. Environments characterised by uncertainty (regulatory and commercial), costs, and conflict, or where significant risks cannot be adequately estimated, are therefore typically avoided (Spence 2016–2017; Posner 2013). The general disposition to such environments, as currently exists in the Nigerian petroleum industry due to protracted regulatory reforms and uncertainties, is to 'freeze', divest, or preserve the status quo in the hope of acquiring more information to support future commercial investment decisions.

In the US, for example, the adoption of a public utility and cost-of-service regulation model under the Natural Gas Act 1938, as well as the Supreme Court's decision in *Phillips Petroleum Co. v. Wisconsin* 347 US 672 (1954), was widely perceived as inconsistent with the goal of enhancing competition and an efficient gas market (Anonymous 1982–1983; Oyewunmi 2017a, pp. 245–247). The subsequent application of uncompetitive regulated pricing on the sale of gas at the wellhead (i.e., upstream) led to shortages of gas supply in the midstream interstate pipeline market (Pierce 1995). From the 1980s to 2000s, the relevant US institutions and market operators responded to the unfolding, security of supply challenge with a rigorous process of law-making, contractual and organisational restructuring, judicial decisions by Courts-of-law, and quasi-judicial decisions by the FERC (Eisen et al. 2015, pp. 545–564). Thus, it is expounded that some of the vital benchmarks that enhance gas industry competitiveness and security of supply include (i) legitimacy for the framework or regulatory action; (ii) accountability; (iii) procedural equity and transparency; (iv) expertise of the regulator; and (v) efficiency of the regulatory framework (Oyewunmi 2014, 2018; Baldwin et al. 2012). Regulatory effectiveness in this regard pertains to the capacity of the institutional framework to serve as a means towards realising identified economic and policy objectives at the least possible cost to relevant operators and stakeholders.

International Gas Markets and Nigeria

Global gas supply and trading are mainly carried out via (i) networks of cross-border pipelines and ancillary facilities; and (ii) the LNG supply value chain. The emergence of decentralised and more competitive energy markets in several industrialised and emerging economies is one of the primary drivers of the increasing global trade and commoditisation of gas. Other factors include technological advancements and innovation in gas-fired power generation, pricing and contractual trends in the LNG markets, the shale gas production boom in North America, as well as the commissioning of new LNG and commercialisation projects in countries such as Australia and Russia (International Gas Union [IGU] 2017b;

BP Plc 2016). The BP 2017 Energy Outlook to 2035 reports that LNG trade will grow seven times faster than pipeline gas trade, with LNG accounting for about half of all globally traded gas.[8] Unlike pipeline gas, LNG cargoes can be redirected to different parts of the world in response to regional fluctuations in demand and supply. Thus, previously isolated, domestic or regional gas markets are expected to become more integrated globally (BP 2018; IEA 2017).

Growing demand for flexible LNG supplies can now be met by (i) LNG production volumes that are uncontracted; (ii) volumes that are contracted to a particular destination but redirected; or (iii) contracted volumes open to multiple destinations (which enable gas to flow to demand centres) (IEA 2016b). Additionally, volume per contract has become smaller, reflecting more open markets, more buyers and sellers, and the growing participation of smaller LNG importers. The reliance on oil price indexation as the gas supply pricing mechanism is now diminishing, while the pricing of 'gas' as a commodity on its own right, that is, gas-to-gas pricing, is increasing. Also, the share of contracts with flexible destinations has steadily increased (IEA 2016b). The IGU's global price formation and wholesale market survey reveals that within the past decade:

(a) Adoption of gas-on-gas (GOG) competition in pricing constituted the largest share of total world gas supply/consumption at 45%, predominantly in North America, Europe, the former Soviet Union, and Latin America. The percentage of oil price escalation (OPE) pricing was about 20%. The regulated pricing categories—regulated cost of service (RCS), regulated social and political (RSP), and regulated below cost (RBC)—accounted for about 31%.[9]
(b) The fundamental changes have been the continuous move away from OPE to GOG in Europe; from RBC to RCS, RSP, and GOG in Russia; from RSP to RCS and OPE in China; from RBC to RSP in Iran; and from RBC to RCS in Egypt and Nigeria. GOG and OPE have also recently benefitted from pricing reforms in India and China respectively (IGU 2017a).

The highlighted trends signify a general move towards reforms and developing more competitive price regulation and market governance structures globally. Furthermore, there is a race for market share in global

markets by the incumbent and upcoming producers and suppliers. This portends keen competition for scarce investment capital by relevant operators and international firms, including NOCs. Thus, countries, such as Nigeria, which depend heavily on export revenues must develop the necessary regulatory and institutional capacities with the required level of efficiency and responsiveness to address necessary trade-offs and risks arising from demand-side shocks in the global markets (Oyewunmi 2018; IEA 2016b, p. 54). A classic example of how global gas markets are changing and its implications for projected gains for stakeholders in exporting countries such as Nigeria is evident in the upswings and downswings of Nigerian LNG exports to the US between 1999 and 2011 (US EIA 2017).[10] The US shale gas production gained traction in the late 2000s and by 2011 there were clear projections pointing to the US becoming the biggest global gas producer and a net exporter of LNG by 2016 as well as a net exporter of natural gas by 2021 (IEA 2016b, p. 47; IEA 2017; BP 2018). US imports from Nigeria, which peaked at about 95,000 metric cubic feet in 2007, were down to zero by 2012, as pointed out in the US EIA data on LNG imports from Nigeria (US EIA 2017).

In an environment where the NOC and its subsidiary (e.g., Nigeria's NNPC and NGC or NGPTC) are expected to be the primary drivers of investments and infrastructural growth in the domestic market, export revenue losses and non-viable or commercially insecure local markets can lead to significant energy security implications. The conclusion of lingering reforms and enhancing the viability and creditworthiness of operators across the gas-to-power value chain will be essential to the nation's energy security going forward (Oyewunmi 2017a, 2018; Tallapragada 2009; Akinpelu and Iwayemi 2010; Iwayemi 2008).

Nigerian Gas Supply Industry and Energy Security

Considering that Nigeria has about 187 trillion cubic feet of proven gas reserves (the largest in Africa), the nation is consuming only a fraction of what it reasonably could to meet its surging energy demand (BP Plc 2017b; World Bank 2004; Santley et al. 2014). While a limited amount

of gas is supplied for power and industrial uses, a more significant portion of gas produced is exported as LNG, flared or reinjected as part of enhanced oil recovery processes (Oyewunmi 2014, 2018; NNPC 2014).

Some of the most significant challenges to the emergence of a competitive and secure gas-to-power value chain in Nigeria revolve around (i) the inadequacy of the domestic gas supply infrastructure, as well as perennial disruptions and affordability of gas supply to power. There is also a perceived lack of creditworthiness and liquidity in the electricity market, which was recently privatised and is undergoing a liberalisation process; (ii) a highly politicised institutional framework that essentially consolidates NNPC/NGC/NGPTC monopoly and control of price regulation and access to pipelines and the market; (iii) a lack of convergence between the evolving electricity market and the gas supply industry; and (iv) rent-seeking and opportunistic private and public stakeholders 'gaming' the regulatory inefficiencies and opacity pertaining to fiscal incentives and resource allocation (Oyewunmi 2017b, 2018; De Vita et al. 2016).

The government's three-in-one role as policymaker, regulator, and commercial operator, via the Minister's office and NNPC, appears directly or indirectly responsible for the regulatory failures and gas market's under-development over the years (Omorogbe 1996; Peng and Poudineh 2017). The drive to reform the legal, organisational, and institutional framework of the oil and gas industry towards international best practices for efficiency, competitiveness, and regulatory effectiveness began in 2000. The broader economic restructuring agenda launched in the 2000s to enhance private-sector participation and liberalisation, and address administrative inefficiencies involved the approval of a National Electric Power Policy 2001 (Electricity Policy), National Energy Policy 2003, and National Oil and Gas Policy 2004 (NOGP). The Electricity Policy was consolidated following the enactment of the Electric Power Sector Reform Act 2005 (EPSR Act) and the creation of the Nigerian Electricity Regulatory Commission (NERC). Furthermore, there was (i) the corporatisation and unbundling of the National Electric Power Authority (NEPA) into 6 generation companies, 11 distribution companies, and a national transmission company; (ii) the privatisation of the successor generation and distribution companies in 2013; and (iii) the declaration of a transitional electricity market towards full liberalisation

(Oyewunmi 2013; Oke 2013). Unfortunately, the restructuring and reforms of the petroleum (oil and gas) industry have remained stunted (Obaseki-Ogunnaike 2017).

The NOGP inter alia prescribed (a) the separation of the Federal Government's regulatory, policy, and commercial roles in the petroleum industry by ensuring distinct institutions perform the respective functions; (b) the corporatisation, restructuring, and eventual privatisation of the NNPC, as well as the unbundling of the NGC into a privatised transmission company, a national gas transport network company, and/or facility management companies; (c) the establishment of a comprehensive National Gas Master Plan (NGMP); (d) the introduction of liberalisation and TPA to the downstream gas sector; (e) creating appropriate gas pricing primarily to facilitate efficiency in the gas supply to power; (f) maintaining a balance between domestic growth and gas export revenue earnings; and (g) enacting a law to consolidate the objectives.

The NGMP provided for a gas pricing policy, the Domestic Gas Supply Obligation (DGSO),[11] and the Gas Infrastructure Blueprint. The attempt to further the NGMP's objectives by issuing the National Domestic Gas Supply and Pricing Policy 2008 (the 'Supply Policy') and the National Domestic Gas Supply and Pricing Regulations 2008 (the 'Supply Regulations') has been incoherent thus far. The Supply Policy's strategic power sector objective of ensuring the delivery of 'low-cost' gas to the power market does not take due cognisance of relevant questions such as the unfeasibility or unavailability of such low-cost gas due to, for example, international gas market dynamics, escalating domestic transaction, and administrative costs, as well as supply disruption issues. The Supply Policy also sought to specify the application of 15% rate-of-return regulation, and other rates and charges. Such policy-based fiscal fixes by the Ministry seem to pre-empt the expected inputs and role of the proposed Department of Gas (DoG) as an independent regulator as well as the extant electricity market regulator, that is, the NERC. The DoG was seemingly established further to the Supply Regulations to function as part of the DPR, which is, in turn, a department under the Ministry. The creation of the Gas Aggregator Company of Nigeria Ltd. (GACN) was also pursuant to the Supply Regulations. The GACN's designated responsibilities seemed to create unnecessary duplication of roles and lack of

proper clarity vis-à-vis the DoG, DPR, and NERC concerning gas-to-power regulation (Oyewunmi 2018; Peng and Poudineh 2017).

The objective of establishing an effective independent regulator for either the gas sector and/or the petroleum industry has been hampered by the inability of the government and relevant stakeholders to ensure the enactment of the required reform law or laws, that is, the Petroleum Industry Bill (PIB) of 2008 and 2012. As a result of the political turmoil that followed the legislative process in 2008 and 2012, the current administration decided to split the PIB into four bills, namely, the Petroleum Industry Governance Bill (PIGB), the Fiscal Regime Bill, the Upstream and Midstream Administration Bill, and the Petroleum Revenue Bill (Oyewunmi 2017c). There are also pointers to a possible Petroleum Host Community Bill and a Petroleum Industry Reform Bill (PIRB). The PIGB is the only bill that is currently in circulation and was recently passed by the Senate and House of Representatives. It requires the assent of the President before it becomes law (Oyewunmi 2017c). An administrative re-arrangement or restructuring of NNPC was recently announced in 2016 involving the creation of new subsidiaries, such as Nigerian Gas Processing and Transportation Company Ltd. (NGPTC), Nigerian Gas Marketing Company (NGMC), as well as a gas and power investment division (Oyewunmi 2018).

The IEA 2017 Gas Market Report Series confirms that structural gas shortages reduced the power generation capacity of Nigeria by about 50% in 2015–2016 (IEA 2017). Gas supply shortages and disruptions have paralysed the electricity sector, hampering any new investments in metering, network expansion, and maintenance. Besides the devastating impact of pipeline vandalism in the electricity sector, the country is faced with energy market failure challenges. The DGSO, which was designed to prohibit independent gas producers from exporting gas until they deliver determined volumes for domestic power producers, has been mostly ineffective. For several years, regulated electricity tariffs were set outside of the gas industry's institutional framework, while the pricing and resource allocation in the gas industry were likewise carried out without adequate cognisance to the peculiarities of the power sector's demand and supply dynamics. Thus, pricing and arrangements for a gas supply to power do not often reflect the actual cost(s) of the gas supply as fuel for

power generation; resulting in the formation of several ad-hoc inter-ministerial and cross-sectoral committees to move prices from a regulated below-cost towards a cost-of-service regime (IGU 2017a; Oyewunmi 2018, pp. 151–157). Additionally, gas producers prefer to sell gas via the global LNG market than to domestic power producers, while electricity distribution companies are usually unable to pay a cost-reflective and commercially reasonable price for the electricity they buy from the power generation companies (O'Sullivan 2017). In fairness to the newly privatised power distribution companies, they seem to have inherited poorly maintained assets and infrastructure, including the required metering and operational networks to effectively determine what would be a fair and reasonable price to charge consumers who themselves are equally wary of private-sector opportunism. Even when the NERC, as the economic regulator for the power sector, is carrying out its statutory roles alongside the new market operators, there is a constant need to efficiently coordinate with stakeholders and institutions in the oil and gas industry for information regarding the cost, pricing, and availability of fuel, that is, gas.

Ongoing Reforms

Following a review of the current institutional issues, particularly in view of the recent trends in the international oil and gas sector, the current Federal Government approved two policy instruments in the context of a National Economic Recovery & Growth Plan (ERGP 2017–2020) (MPR 2017a, b). These are (i) National Gas Policy 2017 ('Gas Policy') and (ii) National Petroleum Policy 2017 ('Oil Policy'). There is also an ongoing consideration of the draft National Petroleum Fiscal Policy 2016 ('Fiscal Policy'). The new policy initiatives fundamentally reflect the core reformative ideas of the 2004 NOGP, while going a step further to articulate necessary policy revisions for the oil and gas sectors. The Oil Policy reiterates the need for less dependence on oil export revenues and enhancement of economic value from energy resources, especially, by promoting gas-based industrialisation. It proposes the development of a private-sector-led and market-driven industry. Both the Oil Policy and

Gas Policy outline the necessary guidelines for the separation of governments' supervisory, regulatory, and commercial roles within the industry. They prescribe the creation of a single, industry-wide regulatory agency, that is, the Nigerian Petroleum Regulatory Commission, while the Ministry remains responsible for policy directives and supervision. The NNPC is earmarked for restructuring and privatisation once the required laws are enacted, while the administration of the sector is expected to become more transparent and efficient.

The Gas Policy is arguably the first, fully publicised policy framework for promoting gas-based industrialisation and domestic market requirements in Nigeria. It also emphasises the need for maintaining a significant presence in international markets. On the organisational structure for the industry, the Gas Policy recommends (i) a mix of public-private participation; (ii) restructuring of NGC into separate transport and gas marketing companies; (iii) strategic partnerships to support the operations of the NGPTC; (iv) developing wholesale market competition; and (v) implementation of the DGSO and reviewing the future role of the GACN. With regard to pricing reforms, the Gas Policy stipulates that the upstream gas price for domestic sales will be set by netback from export-parity prices. It proposes a transitional period after which a market-led wholesale gas pricing will be the norm. In consonance with the Fiscal Policy, the gas industry operators should also expect a fiscal framework which recognises gas as a standalone commodity and industry, separate from oil.

While the Gas Policy's statement that private operators must view the DGSO framework as their own contribution to national development and doing business in Nigeria seems understandable from a government perspective, it should be highlighted that the idea of grounding the issuance and renewal of upstream licences on compliance with the DGSO may be unrealistic and counter-intuitive. Note that NNPC and IOCs hold the most resourceful E&P acreages under various arrangements, such as JV/JOA or PSCs. Under PSCs, NNPC is the licence holder or leaseholder, while the corporation is also a leaseholder to the extent of participating interests held in JV/JOAs. Thus, it is unrealistic to suggest that NNPC will be denied the renewal or issuance of a licence or OML. Arguably, the failure to treat IOCs and NNPC equally without discrimination in this regard may have international law and investment protection implications (Hirsch 2011; Cameron 2014).

Another possible implementation challenge with the Gas Policy relates to its prescription of a National Gas Focal Point and dedicated project desks within the Ministry. The Gas Focal Point is expected to carry out oversight and functional implementation roles for overcoming any obstacles and ensuring consensus and a coordinated development among all industry participants. The 'Project Desks' will serve as the interface between project developers and government agencies. It should be noted that if law or regulation does not clearly define the role and scope of authority of these offices within the Ministry, this may lead to overlaps and administrative bottlenecks vis-à-vis the expected role of the proposed regulator. Such a regulator, with potential economic and quasi-judicial functions, should be allowed and equipped to act independently and competently. Overall, it is also noted that national plans, policies, and guidelines issued by one administration can be replaced and changed by the next or the same administration. Therefore, unless the government takes more law-based and firm implementation steps, the atmosphere of regulatory uncertainties and inefficiency perceptions by current and potential investors in the gas supply for domestic energy uses could continue to undermine energy security in Nigeria.

Conclusion

The capital-intensive, commercial, and operational elements of gas supply projects mean that they may remain unfeasible if only dedicated to an under-developed or non-viable domestic energy market. Thus, developing a competitive, secure, and reliable local supply value chain, while maintaining global export-related capacities, is essential to energy security in countries such as Nigeria.

In promoting the security of supply dimensions of energy security, the instrumental role of regulation through formal institutions such as laws, judicial and quasi-judicial decisions, as well as public and private organisational institutions such as contracts and independent regulators, cannot be over-emphasised. Regardless of the approach, the objectives involve creating a stable investment climate to underpin significant investments, usually spanning decades, in the country's petroleum

resources. An effective gas sector policy and institutional framework would comprise the promotion of gas deliverability; affordability of gas; commercialisation of supply to enable secure willing buyer/willing seller arrangements; availability of gas to meet energy demand and supply requirements; competitive and non-discriminatory market access, and clearly defined regulations, which promote transparency and role clarity amongst stakeholders; and cover issues such as third-party access, pipeline ownership, and tariff structures.

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Notes

1. The Petroleum Act 1969 CAP P10 Laws of the Federation of Nigeria 2004 ("PA").
2. The NNPC was created pursuant to the Nigerian National Petroleum Corporation Act 1977.
3. Author's copy. See also OGEL legal and regulatory database at www.ogel.org/legal-and-regulatory-countries-browse.asp?country=156.
4. See the OGEL Journal's Legal and Regulatory database collection on Tanzania at www.ogel.org/legal-and-regulatory-detail.asp?key=11506. Accessed August 5, 2017.
5. The Constitution of the Federal Republic of Nigeria 1999 as amended.
6. CAP P13, Laws of the Federation of Nigeria, 2004.
7. The current domestic gas pipeline infrastructure mainly comprises two unintegrated pipeline networks of approximately 1100 kilometres: (i) the Alakiri-Obigbo–Ikot Abasi Pipeline (the Eastern Network), and (ii) the Escravos–Lagos Pipeline System (ELPS) (the Western Network), as well as the dedicated pipeline infrastructure owned by the Nigerian Liquefied Natural Gas Company (NLNG), the NNPC/SPDC/Total JV, and the Chevron/NNPC JV.

8. See BP Plc. 2017. BP Statistical Review of World Energy 2017, p. 35 available at www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html. Accessed October 12, 2017; BP Plc. 2017. BP Energy Outlook to 2035 (2017 edition) p. 56, available at www.bp.com/content/dam/bp/pdf/energy-economics/energyoutlook-2017/bp-energy-outlook-2017.pdf or www.bp.com/en/global/corporate/energy-economics/energy-outlook/energy-outlook-downloads.html. Accessed October 12, 2017.
9. The categories of OPE, GOG, Bilateral Monopoly, and Netback from Final Product can be broadly described as "market-based" pricing, while the categories of RCS, RSP, and RBC can be classified as "regulated" pricing.
10. See data from US Energy Information Administration on the U.S. Liquefied Natural Gas Imports from Nigeria (Million Cubic Feet) (1997–2016) at https://www.eia.gov/dnav/ng/hist/n9103ng2a.htm. Accessed October 12, 2017.
11. The DPR's 2014 National Oil and Gas Report, reveals a dismal compliance level, that is, an annual 20%–35% average compliance with DGSO requirements between 2008 and 2014. The major reason for poor industry compliance is the preference of producers for the more competitively priced export market; inadequate domestic pipeline infrastructure; slippages in project execution and budget constraints; failure of swap deals; and non-readiness of offtake power plants.

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