SIXTEENTH PLENARY MEETING OF THE POLICY DIALOGUE ON NATURAL RESOURCE-BASED DEVELOPMENT

30 June – 2 July 2021

Draft summary report

The meeting was conducted under Chatham House Rule: "When a meeting, or part thereof, is held under the Chatham House Rule, participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed." Recordings of the meeting were made for internal OECD use only.

I. Meeting objectives and structure

On 30 June – 2 July 2021, 23 government delegations from Africa, Asia, Europe, Latin America and the Caribbean and North America, as well as representatives from 9 partner international organisations and institutions, and 17 major firms, industry associations, civil society organisations, academia, law firms and think tanks, convened by videoconference for the Sixteenth Plenary Meeting of the Policy Dialogue on Natural Resource-based Development. International organisations and institutions represented included the Commonwealth Secretariat, the European Commission, the Extractive Industries Transparency Initiative (EITI), the International Energy Agency (IEA), the International Monetary Fund (IMF), the Nuclear Energy Agency (NEA), the Organization of the Petroleum Exporting Countries (OPEC), the United Nations Conference on Trade and Development (UNCTAD), the United Nations University's World Institute for Development Economics Research (UNU-WIDER), and the World Bank. Ms. Ayumi Yuasa, Deputy Director of the OECD Development Centre delivered the welcoming remarks and Mr. Jeffrey Schlagenhauf, OECD Deputy Secretary-General delivered the opening remarks. Mr Brendan Devlin, Strategy and Foresight Counsellor, Directorate General for Energy, European Commission and Dr Kelechi O. Ofoegbu, Senior Technical Adviser to the Honourable Minister, Ministry of Petroleum Resources, Federal Republic of Nigeria co-chaired the Sixteenth Plenary Meeting.

II. Summary of the Discussion and Conclusions

Participants welcomed the zero draft of the Equitable Framework and Finance for Extractive-based Countries in Transition (EFFECT), and the opportunity to discuss enabling measures and incentives for the decarbonisation of extractives under Pillar 1. Participants noted the strength of the Framework in offering a menu of options for what extractive-based developing and emerging economies can do to transition to a low-carbon economy. However, participants also emphasised the importance for the Framework to address how to fill significant capacity and institutional gaps that may constrain extractive-based developing and emerging economies' ability to deliver on the recommendations contained in the Framework. When discussing the importance of enabling access to finance, participants noted the increased uncertainty around the extent to which existing reserves of fossil fuels will be exploited and the corresponding effect on financial markets, which in turn, may drive extractive companies out of business. While extractive companies can take the risk, letting countries

fail is not an option, as beyond market considerations there will be significant political, humanitarian, and socio-economic consequences.

Participants recognised the crucial role that the oil and gas industry must play in supporting the low carbon transition, in particular in developing and emerging economies where hydrocarbons will remain part of the energy mix for longer and where the pace of penetration of renewable sources of energy, electrification and deployment of electric vehicles is likely to be slower. Participants noted that oil (25 million bbl. per day) and gas (1700 bcm per day) supply will still be needed under the IEA's Net Zero by 2050 scenario, primarily for the production of petrochemicals and hydrogen. In this respect, participants emphasised that pathways towards net-zero should not only reduce CO2 emissions but also enable universal access to energy. Access to energy for all by 2030 remains an important goal but challenges including distribution, population increase and urbanisation will have to be met on a case-by-case basis as there is no one size fits solution for all developing and emerging economies.

The EFFECT Framework recommends that a transitional step towards a net-zero economy, where fossil fuels are part of the energy mix, is to reduce emissions from production, transportation and processing, through the deployment of the best available technologies and practices. Participants discussed the importance of balancing short-term pressures and long-term vision and objectives, and noted how International Oil Companies (IOCs) could play a role in supporting developing and emerging economies in their scenario planning. Participants agreed that decarbonising fossil fuel production, transport and processing is a priority for developing and emerging economies. In order to achieve the objectives of the Paris Agreement on a global basis, advanced economies need to support developing and emerging economies in terms of both technology transfer and finance. Without this level of sustained international cooperation and knowledge sharing, net zero will not be reached by 2050 and the low-carbon transition will be delayed by several decades. To support this collaboration, governments should ensure that they establish transparent and predictable policy and regulatory frameworks, including multi-layer governance where central government can work alongside regional and local governments on a multi-sectoral and multi-level basis. In this regard, participants noted how there is an opportunity to embed universal energy access provisions in COVID recovery packages. The World Bank Import Gas Flared Index provides a useful reference to understand how new forms of collaboration between producing and consuming countries could look like. While seven countries account for 65% of global gas flaring, importing countries have a shared responsibility to catalyse efforts and use their influence to reduce flaring through their relationship with suppliers and producers, because when they buy oil from high flaring countries they also import the flaring intensity that goes with it.

Under a Paris-aligned scenario, over the next 10 years, global emissions need to be reduced by 40%. Most of the technology needed for this reduction is already available and cost effective, by decarbonising the electricity sector and electrifying a number of sectors, including transport. Participants noted the role that gas can play to enable this transition, by improving the reliability, flexibility and security of the grid, addressing the intermittency challenge of variable renewable energy sources and reducing the cost of decarbonising the power sector. However, the role of gas in the transition is strictly correlated to the actions taken by governments and industry to reduce its carbon footprint. IOCs can leverage joint ventures with NOCs to drive down methane, CO2 and other emissions, by deploying measurement and detection technologies, carbon capture and storage, and disclosing information on flaring, venting, and enhancing NOCs' capacity for emissions abatement. Participants emphasised the importance of collaboration for technology transfer not only between IOCs and NOCs, but also amongst NOCs, and between NOCs and local companies. Participants called on the OECD to facilitate a structured process for knowledge sharing and collaboration. In particular, participants identified methane emissions reduction as a low-hanging fruit to simultaneously achieve climate, energy access and economic development objectives as well as continuous market access, as the European Union is considering making the import of oil, gas and coal conditional on effective measurement and reporting on methane emissions.

Prioritising the utilisation of associated gas, which would be otherwise wasted through flaring and venting, would reduce CO2 equivalent emissions by 400 million tons each year. When considering the challenges for putting associated gas to productive use, participants pointed to the absence of an enabling and enforceable regulatory framework. They also noted how gas is often developed on the back of oil to monetise higher revenues, before the necessary midstream and downstream gas infrastructure is in place. Gas utilisation projects also competes for capital against investment for additional oil production. Transporting gas where it is most needed for power generation, industrial or residential purposes can also be problematic. In Ghana, this challenge was addressed by reversing the flow of gas in the West Africa gas pipeline to supply the domestic market. Stabilising demand from off-takers is also necessary for gas supply to keep pace with demand, through the conversion of thermal into gas fired plants, with huge investments required to build transmission lines and by stimulating additional internal demand. Participants noted that for gas that is marketed domestically, it is important to establish a good pricing structure from the start and avoid artificially subsidising gas prices. If gas prices are set too low, it can be politically very challenging to raise them later to develop an attractive domestic gas market. Efforts to curb flaring are underway in developing countries. For example, Nigeria has reduced the flaring of associated gas from 60% to 6% and now requires all new upstream projects to have a plan for evacuating or commercialising associated gas, and has imposed penalties for flaring. The new Petroleum Industry Bill also provides that the proceeds from flare penalties would be used to carry out environmental remediation.

Day 1: Equitable Framework and Finance for Extractive-based Countries in Transition (EFFECT) – Pillar 1: decarbonising extractives: what can governments do?

Day 1 of the Sixteenth Plenary Meeting provided an opportunity to discuss the *Zero Draft Equitable Framework and Finance for Extractive-based Countries in Transition (EFFECT*), which was developed under the guidance of a Multi-Stakeholder Steering Committee between February–June 2021. The Framework is structured around three pillars:

1) The decarbonisation of extractives through the deployment of low-carbon technologies, the identification of enabling measures and incentives, and financing options;

2) Sustainable exit strategies from fossil fuels and just transition plans;

3) Systemic decarbonisation of fossil-fuel economies, by exploiting cross-sectors synergies, green industrialisation, diversifying portfolios and skills, and by increasing the share of renewables in the energy mix.

Day 1 of the Sixteenth Plenary Meeting focused on the first pillar of the Framework – specifically, the Preamble, transition risks, and the draft enabling measures and incentives that governments can put in place to decarbonise extractives. Participants welcomed the zero draft of the Framework and noted that the objective of the Framework is to provide guidance to extractive-based developing and emerging economies, industry and financial institutions to enable an equitable and just transition to a low-carbon economy, by managing uncertainties and increased vulnerability, building resilience to external shocks and reducing the risk of high carbon lock-in associated with short-term investment decisions with effects in the medium to long-term, stranded assets and competitiveness losses.

Participants recognised from the outset that developing and emerging economies face different challenges with respect to advanced economies to advance efforts towards a low carbon economy. In this regard, there are no easy answers, as countries embark on the transition from different starting points, with different needs, trajectories and paces of structural change necessary to achieve net-zero. Participants acknowledged that while achieving net-zero emissions will be extremely difficult for all countries, the challenges are toughest and the solutions harder to find and implement in extractive-based emerging and developing countries. Participants also noted the divergence between different developing and emerging economies in terms of the development of their extractive sectors. It was noted that Gulf economies and big producers may be able to transition to a hydrogen economy due to their larger

financial cushions and technical experience. However, smaller and new producers suffer multiple constraints and will find this process more challenging.

Participants considered the transition risks that developing and emerging economies will face as the global shift toward a low carbon economy progresses. Transition risks are understood as the economic implications of the transition (as opposed to the physical impacts of climate change), and these include declining demand for oil and gas, declining economic value of carbon-intensive investments, risk of stranded assets or undeveloped resources. Participants noted how the Framework recognises that exposure to transition risks increases with the importance of fossil fuel export revenues for macro-economic stability, the carbon intensity of manufacturing exports, the use of fossil fuels as an energy source for domestic power production or as an industrial feedstock for energy-intensive and high-emission industries such as metals, cement, chemicals, fertilizers, and heavy industries, low levels of economic diversification, rapid demographic growth and urbanisation with growing demand for energy, as well as increased exposure to natural disasters and a limited resource-base and/or industrial base.

There is a growing uncertainty over the revenues that governments will receive from fossil fuels over time and governments depending on this revenue will likely experience a volatile and shrinking global market for their products for export. Participants discussed policy and practical approaches that governments of developing and emerging economies should consider:

- Economic governance – countries should stress test their economic stability and resilience under different transition pathways. They will need to consider market prices but also domestic consumption and the split between export and domestic fuel use, as well as reassessing revenue management in light of different scenarios, and sustainable spending to support the transition.
- Energy, industrial and climate planning – countries should set robust energy and power policies from the outset in order for sustainable diversification to be on the right track. Participants noted that ministries don't always talk to each other and share planning, so taking an integrated approach to energy and climate planning is important.
- Upstream planning – countries should focus on building technical and policy capacities for emission mitigation, understanding carbon pricing, and addressing knowledge asymmetries between the domestic sector and foreign companies. Governments will need to set a strategic path for NOCs (and this may require changing their mandate), and manage risk through licensing and contracts – looking at long-term liabilities, and the fact that international companies are now thinking of much shorter timeframes for investment and may at short notice choose to divest from fossil fuels.

Participants discussed the concept of resources and noted how many large companies use hydrocarbon assets/resources as collateral for investments. However, as the speed of the energy transition increases, those dynamics will change the value of natural assets as vast tracks of land are lost to desertification, additional pressure is placed on water etc. Consequently, some participants observed that "resources" may not be the best term to describe existing reserves of oil, gas and coal.

Participants discussed the specific enabling measures and incentives that the EFFECT Framework recommends that governments put in place in respect of upstream electrification, methane emissions reduction, and carbon capture and storage (CCS). Governments are advised to adopt incrementally stronger policies for emission reduction to incentivise and promote a transition to future lower-emission technologies and influence the development of domestic gas market reforms. Without such enabling measures, high natural gas supply may accelerate the phase-out of coal-fired electricity, but will also increase electricity use and slow the decarbonisation process, by delaying the use and price-competiveness of renewable energy technologies.

Participants noted how reducing methane emissions is the single most important way to bring down emissions and improve efficiency in the oil and gas industry. The Framework recognises the importance of reducing methane emissions and recommends that governments establish a regulatory and measurement, disclosure and reporting, and verification framework for NOC and IOC flaring, methane venting, and carbon emissions, using existing reporting templates. Governments are also advised to take steps to understand the barriers that may prevent companies from undertaking actions to drive methane reductions that appear to be cost-effective – for example, information, infrastructure and investment incentives.

Participants considered the specific example of methane emissions reductions in Canada through the use of regulatory tools. It is important for governments to set out a roadmap well in advance of its proposed emission reduction target dates. For example, Canada set the objective to reduce methane emissions by 2025. Discussions around methane emission reductions began in 2016, regulations were proposed in 2017, and were finalised in 2018. Following feedback from industry and other stakeholders, the regulations were amended in 2020. Throughout the process, engagement with industry stakeholders was important so that expectations were clearly set out from the beginning. Then the regulator was able to move forward with actions that address specific sources of emissions. In addition to engagement with industry stakeholders, engagement across government (sub-national governments and other ministries) was also vital to ensure a whole of government approach to the challenge of reducing emissions.

Participants discussed the value of good data on emissions and noted that this is a barrier that needs to be addressed. In the Canadian context, there were serious questions about what the real emissions number was at the beginning of the process. Consideration was given to whether the regulatory process should be stopped until better data was developed. However, it was decided that the data was good enough to start the process on emissions reductions. Participants noted the importance of sharing data openly to advance knowledge in this area. This can include industry investments, academic work and government investment to understand emissions – such as satellite data. Participants noted how the European Commission has a series of satellites in place under the Copernicus Programme. The Sentinel 5P satellite has a chemical spectrometer on it and does daily surveys for methane emissions. All data collected is then published as a public good and can be accessed. Participants noted how satellite data will be crucial tool to inform policy developments going forward.

Alongside the reduction of methane emissions, upstream electrification and the deployment of CCS can also contribute to transition to a low carbon future. Upstream electrification is a key area for reducing carbon footprint. The IEA estimates that just over 50% of global oil production today could reduce emissions from energy extraction by connecting to the power grid. The deployment of CCS to achieve long-term emission reductions is necessary to avoid substantial contribution to additional global warming from energy intensive and hard-to-abate industry sectors. Participants noted how governments should allocate CCS projects to entities that already have the required capacity with regard to geological knowledge, relevant operational experience, and infrastructure capacity to develop and operate CCS infrastructure – in many cases this would be the National Oil Companies (NOCs). However, where the NOC or other relevant government entity does not have these capabilities, consideration should be given to leveraging joint ventures with more knowledgeable and experienced International Oil Companies (IOCs) to foster technology transfer.

Participants discussed the key role that finance should play in the low carbon transition. Access to finance remains a major obstacle for many developing and emerging economies, and as a result, the Framework recognises that action is needed to enable access to finance for countries that will have high emission profiles, including their NOCs. Many developing and emerging economies do not qualify for green finance, as they do not meet the required benchmarks for greenhouse gas emissions. Participants

noted how this could slow the transition of these countries, as there is a real possibility of capital flight out of emerging markets as climate relate risks begin to be priced in at the sovereign risk level, the corporate level and the project level. Participants further noted the increased significance of environmental, social, governance (ESG) criteria in international lending and how that could lead to developing and emerging economies being locked out of international financial markets. The market is starting to value IOCs differently than before, and participants noted the increased uncertainty around the extent to which existing reserves of fossil fuels will be exploited and the corresponding effect on financial markets, which in turn, may drive extractive companies out of business. While extractive companies can take the risk, letting countries fail is not an option, as beyond market considerations there will be significant political, humanitarian, and socio-economic consequences.

At the same time, participants questioned the opportunity to invest in technologies to reduce the carbon footprint of an industry with a defined end of its business model. It was observed that while it is recognised that the role of oil and gas will progressively decline and that the share of renewable sources of energy is expected to grow everywhere, including in developing and emerging economies, the pace of penetration of renewable sources of energy, electrification and deployment of electric vehicles is likely to be slower and hydrocarbons still required for refineries to produce fuels and to generate revenue to finance the low-carbon transition. So, what matters for developing countries in transition is that fossil fuels are produced, transported and processed in a low-emission way, with the deployment of the best available technologies.

In order for developing and emerging economies to improve their ability to access green finance, participants discussed the potential for implementing solar energy as a low hanging fruit. Solar PV will be an important component of the future energy system, and the sooner a country begins developing its domestic capital market and skills base to support solar energy the better. Participants noted the capital intensive nature of these technologies and the currency risk, which is a significant barrier to the widespread uptake of solar energy. In fact, it is easier to secure international finance for oil projects in USD, while it is much harder to secure international finance for solar energy projects as these are priced in the local currency. Most banks don't have capacity to take on local currency risk. However, if a country developed its domestic equity market and lending market which would seek exposure to that same currency then this issue would dissolve. But in many developing and emerging economies there is simply not the capacity among the banks to lend at the scale that would be required for those projects.

In response to the challenges identified for developing and emerging economies in accessing green finance, participants welcomed the section on transition finance in the Framework. In this context, transition finance refers to financial instruments that target progress on climate and environmental performance, rather than satisfying certain climate and environmental benchmarks. So, transition finance is forward looking as opposed to green finance that assessing performance on the past.

Alongside finance, participants noted the necessity of capacity and effective institutions in order to implement the recommendations set out in the Framework. In many developing counties, it is already a challenge for regulatory agencies to evaluate financial returns from one project, let alone the complexity of looking at an entire sector. There is no lack of climate ambition on behalf of developing and emerging economies, but there are likely to be significant capacity constraints. Consequently, participants recommended that, for example, the Framework also considers how the private sector can support capacity building, in particular for scenario planning.

Day 2: Towards an Equitable Framework and Finance for Extractive-based Countries in Countries in Transition (EFFECT): What can industry do to support the low-carbon transition?

Day 2 provided the opportunity to present the revised section on what industry can do to support the low-carbon transition. The extractive industry is at a crossroads and facing increasing internal and external pressures to reduce emissions. The overarching approach of the recommendations is that, since fossil fuels will remain an important part of the global energy mix in the transition phase to a low-carbon economy, emissions from fossil fuels production, transport and processing should be reduced through the deployment of best available technologies. The recommendations therefore target the cleaning up of operations upstream midstream and downstream. The Secretariat noted that the Framework contains specific recommendations for IOCs and NOC, as well as collaborative approaches with potential multiplier effects.

Participants recognised the crucial role that the private sector must play in supporting the low carbon transition, and in that regard participants welcomed the opportunity to discuss the zero draft recommendations targeted at the oil and gas industry to achieve carbon neutrality that were developed by the *Working Group on the Role of National and International Oil Companies in the Low-Carbon Transition.* Participants reiterated the business case for cleaning up oil and gas production, transport and processing in developing and emerging countries, as the penetration of low-carbon energy sources will be slower and fossil fuels will remain dominant for longer. In particular, natural gas can act as an enabler for the transition, as it could provide increased flexibility for the integration of renewable energy sources, and in some cases can reduce the cost of deploying variable renewable energy. This is because a high penetration of renewables requires additional investments in transmission and battery technology. Natural gas can in these cases improve the reliability of the grid, and also the cost of decarbonising the energy sector. Therefore, the business case for decarbonising fossil fuels will be higher in developing and emerging economies than in advanced economies. Participants also clarified that the future of natural gas is correlated with efforts by governments and companies to reduce methane emissions and enable access to technologies.

Participants identified three main reasons for natural gas to play to play an important part of the energy mix in 2040. First, more than 30% of total fossil fuel use in 2050 in the IEA net zero (NZE) scenario – including 70% of oil use – is in applications where fuels are not combusted and therefore do not result in any direct CO2 emissions. Examples of this include use of fuel as chemical feedstock and in lubricants, paraffin waxes and asphalt. Second, in the IEA NZE scenario, around half of fossil fuel use in 2050 is in plants equipped with CCUS (around 3.5 Gt CO2 emissions are captured from fossil fuels in 2050). Furthermore, around 925 bcm of natural gas is in this scenario converted to hydrogen with CCS. Hydrogen produced from natural gas with CCS was considered important to address the intermittency challenge of renewable sources of energy and scale up demand, as transport costs remain high, while the costs of green hydrogen are brought down. In addition, around 400 Mtce of coal and 225 bcm of natural gas are used with CCS in the electricity and gas sectors, mainly to extend the operations of young facilities and reduce stranded assets. Third, the remaining 20% of fossil fuel use in 2050 in the NZE scenario is in sectors where the complete elimination of emissions in particularly challenging, such as fuel aviation and heavy industries.

Participants observed that currently production costs of blue hydrogen produced with fossil fuel feedstock (methane and coal) with CCS are lower than green hydrogen produced by electrolysis with renewable energy. Participants noted that blue hydrogen can play a significant part in the energy transition. CCUS transport and storage costs for blue hydrogen range from USD 10-30, according to the IEA. Participants observed that producing hydrogen from fossil fuels with CCS will likely remain

the cheapest low-carbon route in regions with low-cost domestic coal and natural gas and available CO2 storage, such as the Middle East, North Africa, Russia, and the United States.

Participants noted that for green hydrogen, the main cost drivers are renewable electricity costs, electrolyser expenses, and the load factor. Renewable electricity represents a large share of green hydrogen production costs. Over the past 10 years, the levelised cost of renewable electricity has declined by 80% and the downward trend is expected to continue. The cost of electrolysers has also fallen by 40% in Europe and the US since 2014, whereas it already remains nearly 80% cheaper in China. The Hydrogen Council forecasts a further 60% fall in their costs between 2020 and 2030 for offshore wind-based electrolysis. The key drivers of this cost decrease include automation, more efficient production processes, technology improvements and increased size of electrolysers.

Participants noted that barriers to scale up CCS include lack of regional knowledge on storage and value, lack of national strategy and standards, lack of regulations (CO2 transport regulations, site characterisation, subsurface MRV framework, reporting), lack of clarity on roles and responsibilities in the risk sharing and storage liabilities, lack of incentives, and lack of standards for construction, operation, and injection of CO2.

Participants observed that greenhouse gas emissions from the production of oil and gas will be about 4 Gt per year, with half of them coming from methane. Participants observed that as of today, 15% of global energy-related GHG emissions come from the process of getting oil and gas out of the ground and to consumers. Participants noted that there are ample, cost effective opportunities to bring down the emissions by minimising flaring of associated gas with resulting CO2 and venting, tackling methane emissions, and integrating renewables and low-carbon electricity into new upstream and liquefied natural gas (LNG) developments. Thus, minimising emissions from core oil and gas operations should be a first-order priority, whatever the transition pathway.

Participants noted that policy mechanisms for reducing methane emissions from the oil and gas sector include standardisation of monitoring, evaluation, and reporting, as well as updates of working practices and technology standards to avoid or reduce methane emissions. Setting targets for methane reductions is also important. Governments may set absolute targets, eventually coupled with intensity targets, depending on the quality of their monitoring, reporting and evaluation (MRV) of methane emissions, and the level of development of their oil and gas industry. Fourth, labelling of natural gas based on emissions will be a significant step forward, and would require a robust MRV framework in place.

Participants observed that strengthening of monitoring, reporting, and verification of methane, CO2 and other greenhouse gas emissions is critical for formulating emissions policy, but also for market access and access to capital. Participants heard that there is a push in the EU and in the US towards greater methane regulation, with the EU planning to issue new legislation on this later in the year. EU oil and gas market access will be conditional on methane MRV. Participants noted that incoming EU legislation will take the standards developed in the Oil and Gas Methane Partnership (OGMP) and put it into law. Participants observed that this means that at least one of the partners in joint ventures needs to be party in OGMP, and to have reported according to its guidelines. Companies thus have an interest in partnering with other companies that have the technology and the skill set necessary to implement MRV according to the OGMP guidelines. Participants observed that new satellite and drone technologies allow not just operators but also regulators to verify the quality of emissions data.

Participants discussed the different international initiatives on methane emission reduction and noted that these initiatives seek to address emissions across the entire value chain including not just upstream, but also during transmission and distribution. For example, the Sustainability Reporting Guidelines, a joint project by International Petroleum Industry Environmental Conservation Association (IPIECA),

the America Petroleum Institute (API), and the International Association of Oil and Gas Producers (IOGP) provides guidance on climate change and energy, climate governance and strategy, climate risk and opportunities, low-carbon technology, greenhouse gas emissions, energy use, and flaring of gas. Another project joint by IPIECA, IOGP and the Oil and Gas Climate Initiative (OGCI) has developed recommended practices for detection and measurement of methane, and will be published in mid-2021.

Participants noted how the Nigeria National Petroleum Corporation's (NNPC) efforts to reduce flaring has followed from policies, incentives, and programs of the Federal Government of Nigeria, including the enactment of Nigeria's Liquefied Natural Gas Act, the Associated Gas Reinjection Act, and the Flare Gas (Prevention of Waste and Pollution) Regulations. Participants observed that the NNPC and its partners are funding some of the flare gas monetisation projects, while others are being executed in collaboration with third-party offtakers. Participants observed that Nigeria's Ofon Upstream Emissions Reduction (UER) initiative makes use of UER certificates, which can then be sold to fuel suppliers, to be counted towards their emissions reduction. In the Ofon case, the UERs were sold to the Total Lindsey Oil Refinery for approximately UER 1 million, to be converted into GHG credits. Ofon UERs were externally verified and validated by Nord Cert Gmbh. Participants observed that Nigeria has a number of projects to capture and process associated gas, and that, where this is not feasible, operators are encouraged to invest in side gas handling capacity allowing them to reinject these volumes back into the reservoir.

Participants noted that the NNPC seeks to achieve low carbon alternatives as a source of energy to power the economy, while ensuring energy security and supporting the Government's efforts to diversify the economy by engendering industrialisation through gas utilisation. This encompasses several infrastructure projects, including three pipeline projects, a fertiliser and petrochemical company, and a multi-purpose industrial project to produce ammonia from natural gas.

Participants learned lessons on technology transfer from the SEEPCO-NNPC joint venture, which has been successful in commercialising associated gas. Transfer technology lessons from the NNPC SEEPCO case study include:

- Transparency: Private oil companies gain from being transparent about their emissions with governments, NOCs, and other partners. In the case of SEEPCO, gas that SEEPCO vented and flared was identified by the NNPC as a business opportunity for capturing, producing and selling not only associated gas, but also non-associated gas for customers in gas-based industries, fertiliser, commercial customers, and a 1500 MW power plant.
- Participation: by sharing management positions between the two companies, the project seeks to foment understanding of applied technologies within the two companies.
- Partner knowledge and experience: it is important to work with partners that have the required capacity. Capacity development can go both ways – from IOC to NOC, but also from NOC to IOC or independent producers. This is particularly the case where the NOC is a large and well-established company with a broad set of competencies, and the private counterpart is a smaller company with a narrower set of capabilities. In this case, NNPC helped SEEPCO enter the midstream space.
- Commercial mind set: it is important to design well-functioning business models across the natural gas value chain, with functional partnerships along each level of the chain.
- Bringing in regulators early: collaborative arrangements need to bring regulators into the picture at an early stage. Early attention to regulatory issues is likely to reduce regulatory compliance costs at later stages, and cumulative compliance costs throughout the lifecycle of the project.
- Customer base: ensure that offtake agreements are ready when the plant starts producing.

Participants observed that, since IOCs have advanced technology, they have already reduced emissions significantly, and the scope for further reductions is smaller than for NOC that have less advanced technologies. IOCs can therefore have higher impact and on methane emissions when they partner with NOCs to deploy advanced technology to NOC operations. Participants noted that while scaling up of CCS is critical for the low-carbon transition, CCS and hydrogen are also becoming commercial opportunities that developing and emerging economies will benefit from only with the successful transfer of relevant technology. Participants observed that with new measurement technologies for methane emissions, and satellite data increasingly being made publicly available, governments and NOCs have new opportunities for monitoring methane emissions on their national territories.

Day 3, Part 1: Putting associated gas to productive use: available options and implementation challenges

The session sought to improve participants' understanding around available options to reduce flaring and venting of natural gas, and making productive use of this valuable resource. Participants observed that globally about 3.2% of natural gas production is flared or leaks into the atmosphere, and that if half of the gas that is flared were utilised, it would be sufficient to power the whole of Sub-Saharan Africa. Participants observed that reduction of flaring and venting is low-hanging fruit. The costs of ending all routine flaring globally would be around USD 100 billion.

Due to dramatic technology improvements over the last 5 years, it is becoming increasingly possible for developing countries to reduce flaring and venting, and IOCs could have an important role in transferring technology to NOCs for this purpose. Participants observed that the availability of satellite data on flaring and venting is increasingly making it possible for developing countries to monitor emissions of companies operating on their territory, while computational fluid dynamics as well as spectral radiology allow for better predictions of how flares will behave under different weather conditions. IOCs are already taking steps to reduce their emissions by harnessing associated gas. For example, BP has committed to installing methane emissions measurement equipment at all its major existing oil and gas processing facilities by 2023, publish that emissions data, and then drive a 50% reduction of methane emissions intensity in its operations. BP is also working with its joint venture partners to set methane intensity targets to reduce emissions to 0.2%, down from current levels of 3.2%, as estimated by the Global Carbon Project. If this were 0.2% target was generalised globally, it would reduce methane emissions by 65 million tonnes per year.

Participants noted the importance of leadership commitment, and that just seven countries are responsible for 65% of all flaring. Whereas those countries, and other countries that have a high incidence of flaring, should take responsibility, importing countries should too. For that purpose, the World Bank has developed the Imported Gas Flaring Index, which helps importing countries determine their imported flaring intensity. Participants observed that countries' priority has often been to bring higher value oil to market as soon as possible, before gas infrastructure can be developed. Participants observed that expectations of oil revenues, in government and in society more broadly, can make it challenging for regulators to prioritise solutions for associated gas. Participants noted that infrastructure challenges can sometimes be solved by re-engineering of pipelines, as Ghana did with the West African gas pipeline. Participants noted that for gas that is marketed domestically, it is important to establish a good pricing structure from the start. If gas prices are set too low, it can be politically very challenging to raise them later.

Participants noted that making productive use of associated gas sits at the nexus of climate change mitigation and energy policy. Participants observed that persistent flaring is due to: i) lack of leadership commitment; ii) regulatory challenges; and iii) economic and technical challenges. With regard to

leadership, participants noted that the World Bank's zero routing flaring by 2030 initiative now has 93 governments, companies, and development institutions as members, but more would need to come on board to reach impact at scale. With regard to regulatory approaches, these can be based on permitting, penalties, incentives, or market based. Participants observed that the failure to make productive use of associated gas is frequently due to an absence of efficient regulatory frameworks, but also to a lack of effective enforcement measures. With regard to economic challenges, participants noted that gas utilisation competes for capital with new oil production, with the latter generally being more profitable. Solving this may require the development of third-party business models, where third parties process and commercialise the gas. With regard to technological challenges, it is a challenge that flaring is frequently distributed across large and remote regions.

Participants observed that developing countries are taking important steps to reduce flaring and make use of associated natural gas. Participants noted that Nigeria has reduced its flaring of associated gas from 60% to 6%. Participants observed that this and future reductions are supported by policy changes in Nigeria that include: i) a requirement for all upstream development plans to include a plan for commercialising or evacuating the associated gas; ii) a requirement for production sharing contracts to include a gas utilisation plan; iii) a requirement for metering of every new flare point, and iv) a penalty for the flaring of gas, with proceeds going to environmental mitigation in host communities. Participants noted that companies are increasingly committing to building the infrastructure required for evacuating gas. Participants observed that Nigeria has made efforts to maximise the use of associated gas as LPG for household cooking in a country with a sizable access gap to clean cooking fuels.

Day 3, Part 2: Shifting away from fossil fuel dependence and building decarbonised economies: pathways towards net-zero

The session provided the opportunity to discuss the IEA's Net Zero by 2050 report and the specific implications for resource-rich developing and emerging economies. To shift away from fossil fuels and build decarbonised economies, resource rich developing countries will need to embrace the challenge of making unprecedented structural changes to their economies, including by planning for the risks and transformational opportunities of global decarbonisation.

Participants noted how many governments and companies around the world have made pledges to achieve net zero emissions by 2050. In this context, the IEA developed a roadmap for the energy sector to reach net zero. Over the next 10 years (to 2030), global emissions need to be reduced by 40% (13 billion tonnes). Most of the technologies that are required to do this are already available and are cost effective. However, while these long-term pledges represent a positive and welcome development, it is critical that they are coupled with near term targets and policies. In the time that a given government or Minister has their time they need to ensure that emissions start to fall. Participants noted that the fight against climate change needs to be understood as a full transformation of social, economic and cultural systems. The global response to the COVID-19 pandemic has provided an example on how governments can undertake significant changes in a short period of time.

In order for countries to move towards the net zero target, there needs to be a huge surge in clean energy investment. In this regard, participants discussed the following key measures that need to be actively pursued by all countries:

- Decarbonising the electricity sector: is one of the key things to do first. Participants noted that there is already evidence of this around the world. For example, the annual capacity installation of wind and solar PV has quadrupled from 2010 to 2020 with around 250 GW of wind and solar installed. However, that needs to increase to 1000 GW by 2030;

- Electrification of a number of sectors: participants noted how the transportation sector is key to bringing down emissions. In 2020 around 5% of global car sales were electric. In 2030, that number needs to reach 60% to align with the IEA net-zero pathway, and by 2035, all sales of internal combustion cars need to stop;
- Boosting energy efficiency: participants noted how there are many energy efficiency measures in building, appliances, transport that could be scaled up quickly; and
- Energy infrastructure: participants discussed how the IEA pathway calls for a tripling of investment in energy infrastructure to make sure that electricity networks are flexible, reliable and secure. This includes investment in electricity networks, vehicles charging points, hydrogen pipelines.

Participants noted that the use oil and gas doesn't disappear entirely under the IEAs net zero roadmap for the energy sector. In 2050, there will still be need for 25 million bbl. of oil and 1700 BCM of gas per day globally. However, this production is not for energy, but rather for the manufacture of petrochemicals and hydrogen. Participants agreed on the importance of making sure that the oil and gas production that is forecast to continue is as low emission as possible. This means stopping flaring, stopping methane leaks, electrifying operations where possible, and deploying CCS, in line with the recommendations in the EFFECT Framework. It is recognised that there will be continued investment into fossil fuel projects, however, this is almost entirely toward existing fields. One of the milestones on the way to net zero is that there is no need for new oil and gas fields, new coal mines, or coal mine extensions. Despite the reduction in fossil fuel investment, the surge we have in clean energy investment will actually lead to a net increase in global economic activity. Analysis from the IMF notes that over the period to 2030, global annual economic growth will be around 0.4 points higher than it would have been without the forecasted clean energy investment.

Participants noted the importance of new technologies in the low carbon transition. The IEA pathway estimates that in 2050 around half of the emission reductions would come from such technology that is not currently available in the market. There is a big role for hydrogen – both green hydrogen (electrolysis) and blue hydrogen (from natural gas) which need to rise from 250 MW to 850 MW in 2030. However, CCS will be key to achieve this increase in low-emission hydrogen in 2030. Participants discussed the key role for fossil fuel producers and the skills and expertise that the oil and gas industry can deploy to facilitate the diffusion of these technologies. Technology such as CCS, hydrogen, bioenergy, offshore wind will require large scale engineering and project management expertise, which IOCs can provide.

Alongside the continued (limited) production of oil and gas, participants noted how the scale up of wind, solar and EV will require large quantities of critical minerals, including copper, cobalt, manganese, rare earth elements etc. The IEA pathway estimates that the total demand for critical minerals will increase by factor of 7 by 2050. The production and processing of these minerals is more geographically concentrated today than oil, and this could create energy security concerns. If supply cannot keep up with demand there will be price volatility. Participants noted that key role for international mining companies to keep up the supply of critical minerals.

Participants considered the importance of international cooperation in supporting extractive-based developing and emerging economies to meet their target under the Paris Agreement. The IEA pathway estimates advanced economies on aggregate will reach net zero by 2045 and then go slightly net negative to compensate as some developing economies will be still emitting in 2050 on residual basis. Participants agreed that just as important as developed economies reaching net zero earlier is them supporting developing and emerging economies to also reach that goal – through finance, technology and innovation. The IEA looked at a scenario with no international cooperation and found that net zero

would not be reached by 2050 and would be delayed by several decades. This is because international cooperation is essential to scale up clean energy in developing economies.

Participants noted how the IEAs net zero pathway is not just about reducing CO2 emissions, but also seeks to achieve the energy related SDG objectives. This includes universal access to electricity by 2030, universal access to clean cooking solutions by 2030, and substantial reduction in air pollution.

Participants discussed the significant challenges in achieving these energy related objectives with an estimated 800 million people without access to energy and 2.6 billion without access to safe cooking fuel (which leads to indoor air pollution). Participants noted the situation in Nigeria where 100 million people are without access to energy, and the population of Nigeria is forecasted to double to 400 million by 2050. At present, Nigeria's electricity grid capacity is around 12,500 MW, but only about 4,000 MW gets to the end consumer for all sorts of distribution challenges. To address these significant challenges, the IEA report sets out a number of on grid, mini-grid or off grid solutions, while for clean cooking, proposed options include LPG, bio stoves, gas, electric cookers. However, there is no one size fits all solution as different countries all have specific local circumstances. Participants recognised that there is an immediate opportunity to embed universal energy access targets in COVID recovery packages and programmes.

Participants discussed the importance of having comprehensive action plans and road maps to reach net zero at a country level, and in that regard considered the specific example of Peru. Peru adopted a National Adaptation Plan to work toward the reduction of 40% of emission by 2030 as agreed in Peru's NDCs. The Peruvian government has estimated that USD 90 billion of investment will be needed to achieve net zero by 2050, but Peru have some advantages over other developing and emerging economies with an abundance of hydroelectricity and a lack of coal in its current energy mix. Peru has begun a process to electrify the economy and its transportation sector and is considering the possibility of generating mitigation through forest management, forest conservation, and restoration of ecosystems.

Participants noted the importance of intra-government coordination and multi-layer governance. In Peru the lead ministry – the Ministry the Environment – is working horizontally with other government ministries, including the Ministry of Agriculture, Ministry Energy and Mines, Ministry of Finance, and the Vice-Ministry of Fisheries as Peru's industrial fisheries depends on only one species (anchovy) so is particularly susceptible to climate change. In addition, coordination among regional and local governments is also important – particularly where there is significant geographical and bio-diversity as impacts of climate change will be different in different parts of the country. Peru's national strategy also includes the private sector and NGOs, in recognition of their roles, in particular that climate action will largely be carried out by the private sector.

Participants discussed the importance of scenario planning for countries to prepare themselves for different roadmaps to reach net zero. Participants noted that the private sector, including IOCs could assist government with scenario planning due to their existing capability (project management, forecasting etc.). For example, Enel played a role in supporting the Peruvian Government in translating its Paris Agreement commitments into a national action plan. Enel began its analysis by examining the scenario at a national level in 2050, then looking at the transition pathway to the 2030 commitments, and finally by setting out the mid-term policy recommendations that need to be implemented as soon as possible. Participants noted the key factors that should be considered when developing national action plans and road maps:

- Public-private collaboration is key to fill knowledge gap. In Peru, the government was able to engage with the private sector in an informal way to share views on technology, opportunities, solutions;

- Sound policy framework coupled with decreasing cost of low carbon technologies;
- Increased investment for the energy transition. Access to finance is key to make transition possible. This is common in all developing and emerging economies; and
- Carbon pricing as a key variable of finance the transition. Carbon pricing allows cost effectiveness but can also impact consumers so it can be a sensitive issue, especially in fossil fuel producing countries.