TOWARDS AN INCLUSIVE FRAMEWORK ON A JUST LOW-CARBON TRANSITION FOR ENERGY-INTENSIVE ECONOMIES

Draft Work Plan for 2021-22

Thursday 25 June 2020, 14th Plenary of the Policy Dialogue on Natural Resources, Virtual Format.

This note presents the proposed work plan for the development of an Inclusive Framework on a Just Low-carbon Transition for Energy-intensive Economies. The work plan will be discussed at the 14th Plenary Meeting of the Policy Dialogue on Natural Resource-based Development.

Building on the achievements, established network and consolidated methods of work of the Policy Dialogue, it is envisaged to merge the work streams on value creation and revenue management and spending to reorient the initiative towards identifying economically, shock-proof and socially viable policy options available to economies with energy-intensive resource-based industries to transition to a low-carbon future and inform the development of transformational development strategies.

This document (i) explains the rationale for undertaking the proposed work; (ii) scopes the issues for consideration framed around technology; enabling policy and regulatory frameworks to incentivise the decarbonisation of energy-intensive economies and de-risk investments; and financing; and (iii) sets out the proposed output results for 2021-2022.

Participants in the virtual session are invited to provide feedback on the draft work plan, by contributing to framing the issues for future consideration and shaping the proposed output results. Participants are also welcome to submit written comments by 20 July 2020 by emailing the Secretariat (lahra.liberti@oecd.org; havard.halland@oecd.org; ruya.perincek@oecd.org). After the session, the draft work plan will be revised in light of any comments received and finalised in view of the 15th Plenary Meeting of the Policy Dialogue on Natural Resource-based Development tentatively scheduled for 1-2 December 2020.

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1 Why energy-intensive economies matter for transitioning the global economy to a low-carbon future.

1. **High carbon energy sources still make up the lion's share of the global energy mix across developed, emerging and developing economies.** The IEA projects that oil and gas will still contribute about half of the world's energy by 2040, even under their most optimistic scenario for climate action (IEA, 2018) and despite the expected decline in demand (Johnston et al. 2020). By way of illustration only, the energy mix of China, India, South Africa and Australia is largely dominated by fossil fuels. China gets 88 percent of its energy from fossil fuels, of which 61 percent from coal, 19 percent from oil, and 7 percent from gas. Whereas energy production from coal has quadrupled since 1990, renewables have been growing fast for the last decade, to 7 percent of the total energy mix. Other energy sources comprise 2 percent nuclear and 2 percent other fuels including traditional biomass (Enerdata, 2019). India gets 75 percent of its energy from fossil fuels, of which 44 percent from coal, 25 percent from oil, and 5 percent from gas. Other sources include 10 percent renewables, 1 percent nuclear, and 14 percent other sources that comprise traditional biomass (Enerdata, 2019). Seventy three percent of India's electricity is generated from coal. Whereas renewables generation capacity has increased, India plans to add 46 GW of coal-driven generation capacity by 2027. Fossil fuels make up 89 percent of Mexico's primary energy supply, of which 44 percent oil, 39 percent natural gas, and 6 percent coal. In addition, Mexico gets 4 percent of its energy from renewables, 2 percent from nuclear, and 5 percent from other sources including traditional biomass (Enerdata, 2019). South Africa's economy is one of the most energy-intensive in the G20. South Africa gets 88 percent of its energy from fossil fuels, of which 70 percent from coal, 15 percent from oil, and 3 percent from natural gas. Additional sources include 4 percent renewables, 3 percent nuclear, and 5 percent from other sources, including traditional biomass (Enerdata, 2019). In South Africa, where 89 percent of electricity is generated from coal, the power sector accounts for 53 percent of GHG emissions. Australia's energy mix is comprised of 32% coal, 34% oil, 27% natural gas, 6% renewables and 1% of other sources.

2. **The clean-energy transition will require large additional amounts of energy-intensive metals.** UNEP estimates that the deployment of low-carbon technologies would require over 600 million tonnes more metal resources up to 2050 in a 2°C scenario, compared to a 6°C scenario where fossil fuels use continues on its current path. With the rising deployment of wind energy, solar, and batteries, the World Bank sees a growing market for aluminium, cobalt, copper, iron ore, lead, lithium, nickel, manganese, platinum, rare earth metals including cadmium, molybdenum, neodymium, and indium, as well as silver, steel, titanium and zinc.

3. **Energy-intensive resource-based industries are a source of significant greenhouse gas (GHG) emissions.** The extraction, processing and transportation of oil and gas is responsible for nearly 15 percent of global energy sector GHG emissions today. Despite the increase in renewable energy and fall in coal in 2018, low-carbon energy sources did not keep pace with gas growth, resulting in a 0.5% increase in energy-related carbon dioxide emissions (IEA, 2020).

4. The production of metals and alloys is highly energy-intensive, and is responsible for 4 to 7 percent of global greenhouse gas (GHG) emissions. The metals value chain, from the mining and crushing of ore, through smelting and refining, is responsible for a significant share of global energy consumption, much of it produced from fossil fuels. Aluminium production alone, which per tonne generates the highest level of emissions, contributes 4% of global emissions. Iron and steel are other big emitters, although emissions per tonne are lower. Furthermore, since high-grade ore bodies are depleting all over the world, metals production will require more ore with lower concentrations of recoverable metal. This will contribute to higher energy requirements, and higher emissions, across the mining value chain.

5. **Before the COVID-19 pandemic, the need for energy–intensive resource-based industries to reduce carbon emissions was gaining traction**. Sweden and India launched the Leadership Group for Industry Transition at the 2019 UN Climate Action Summit to enable the transition of heavy industry towards net zero carbon emissions by 2050. Leaders in the energy sector and the global investment community participating in the Vatican Dialogues, "The Energy Transition and Care for Our Common Home" have recognised the urgent need for a significant acceleration of a just transition to a low-carbon future beyond current projections, requiring sustained, large-scale action and additional technological solutions to keep global warming below 2°C.[1] Relevant industry-wide initiatives and partnerships include the Oil and Gas Climate Initiative (OGCI), IPIECA, the World-Bank led Global Gas Flaring Reduction Partnership, and the UN-led Oil and Gas Methane Partnership. The biggest mining groups have also expressed commitment to aligning their business models with the Paris Agreement.

6. **Uncertainty looms large over the future of the decarbonisation of energy-intensive economies in the post-COVID world.** With the COVID-19 outbreak, the world is experiencing a drop in energy demand seven times the decline after the 2008 financial crisis. While demand for fossil fuels has been falling due to reduced levels of trade, travelling and the overall lockdown, low-carbon technologies are expected to extend their lead as the largest source of global electricity generation, reaching 40% of the power mix in 2020 (IEA, 2020).

7. **The oil price collapse might affect many producing countries' financial stability and their ability to respond to the pandemic.** In many oil exporting developing countries, oil exports account for as much as 60% or more of fiscal revenue – in some cases above 90 percent. Assuming an average oil price of 30 USD per barrel, which may well be too optimistic, these revenues could by IEA estimates fall by as much as 50% to 85% in 2020, compared with 2019. In addition, several oil-exporting countries are already fiscally constrained, with debt levels higher than they were ahead of the 2008 financial crisis, and indebted national oil companies.

8. In consuming countries with significant fossil fuel resources largely used for domestic use and with limited net energy trade, low oil prices may make renewable energy sources less competitive and lead to increased demand for oil and gas, while oil consumption could become more attractive to consumers.

9. At the same time, the slump in oil prices could facilitate the removal of inefficient fossil fuel production and consumption subsidies and the introduction of effective carbon pricing to reflect the true cost of products, including carbon externalities. Gaining social acceptance of these reforms should be easier in periods of low oil prices, as consumers would still enjoy much cheaper gasoline and diesel than usual. On the other hand, demand for coal may also rebound for energy security reasons, if gas prices were to rise or to compensate for the lack of reliability of the low-carbon electricity system.

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[1] Participant statements on carbon pricing and disclosures signed at the Vatican dialogue on "The Energy Transition and Care for Our Common Home" (14 June 2019) available at https://news.nd.edu/news/vatican-and-notre-dame-co-sign-climate-change-accords-with-energy-and-finance-executives/

10. **Decisive action at the national and international level is needed to put energy – intensive economies on a low-carbon development pathway.** The fact that fossil fuels heavily dominate the world's energy production, despite the growing demand and deployment of renewable energy sources, explains why the decarbonisation of fossil fuels and other energy intensive resource-based industries (mining and metals used for manufacturing low-carbon products) is key to meet climate objectives and limit warming to 1.5°-2°C by the end of the century.

11. The key challenge for policy makers is be to find ways to sustain the low-carbon transition and seize the opportunity for advancement to support an inclusive, low-emission and resilient recovery in the post-COVID world[2].

12. **Piecemeal and inconsistent approaches are still common.** The Paris Agreement invites countries to prepare long-term, low emissions development strategies in addition to the national climate commitments they pledge every five years starting in 2020. While considered in some instances, the approach to the low-carbon transition has often been fragmented and not part of a holistic approach to economic restructuring (Worrall, L. R. and Whitley, S., 2018). For example, Egypt's 2030 Green Economy Strategy includes plans for significant coal power expansion. Policy coherence is yet to be achieved so long as governments send confusing GHG abatement investment signals by adopting measures intended to protect the competitiveness of trade exposed industries with free permits or carbon tax exemptions.

13. **Attempts to design long-term, just and inclusive low-carbon development pathways are emerging.** Several governments are already considering how to design equitable and inclusive low-carbon development pathways that address the need to achieve emission targets, while taking into account any adverse impacts on low-income households, health and employment. For example, Canada, France, Germany, South Africa and Spain, have developed or are working on transition plans that account for the social impacts on workers and communities of the transition away from coal. Costa Rica included social aspects in its decarbonisation plan. The Solidarity and Just Transition Silesia Declaration, adopted at COP 24 under the Presidency of Poland, reflects the need for an integrated approach that combine climate priorities, economic needs and social consequences. The Declaration further recognises the specific needs and circumstances of developing countries, especially those most exposed to the adverse effects of climate change and most vulnerable to natural disasters and exogenous shocks[3].

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[2] Statement by the OECD Secretary-General, Angel Gurría, An inclusive, green recovery is possible: The time to act is now, (22 April 2020), available at http://www.oecd.org/coronavirus/en/ .

[3] The Solidarity and Just Transition Silesia Declaration, United Nations Climate Change Conference, COP24 Katowice, 2018 https://cop24.gov.pl/fileadmin/user_upload/Solidarity_and_Just_Transition_Silesia_Declaration_2_.pdf

2 The role of the OECD Development Centre in supporting the low-carbon transition.

14. **A new toolbox is needed to manage the transition to a low-carbon future.** Emerging and developing economies that are still heavily reliant on energy-intensive industries need to consider a new toolbox to manage the transition to a low-carbon future in a sustainable manner, build their resilience to external shocks, and embrace the challenge of making unprecedented structural changes in the way energy is produced and consumed. Specific consideration should be given to the responses to the COVID-19 crisis, as they may affect the pace of the structural changes required to sustain the low-carbon transition.

15. **The OECD Development Centre was called upon to contribute to advancing the low-carbon agenda.** At its Fifth High-Level Meeting (HLM) held on 21 May 2019, the Members of the Governing Board invited the OECD Development Centre to "help design transformational development strategies aligned with the 2030 Agenda focusing on sustainable transition of natural resource-rich developing countries towards a low-carbon economy and better integration into global value chains" [4]. This work will also contribute to filling the knowledge gaps and follow-up on areas for future work identified by participants in the 2019 OECD Green Growth and Sustainable Development (GGSD) Forum (Paris, 26-27 November 2019) on "Greening heavy and extractive industries: Innovation and fiscal implications". These include: (i) understanding realistic options (beyond economic diversification) for resource-rich countries that derive 50% or more of their government revenues from fossil-fuel resources; (ii) mobilising resources for the low-carbon transition, including by increasing collaboration between sovereign and strategic investment funds; (iii) designing the required long-term policy certainty for firms to invest in breakthrough technologies and unlock demand for green metals either through public procurement geared towards driving green innovation or by encouraging initiatives from the private sector; (iv) considering whether and how to level the playing field with different policies, standards and carbon pricing across jurisdictions.

16. **Scaling up work on the low-carbon transition in energy-intensive economies.** In response, the OECD Development Centre will refocus the activities of the Policy Dialogue on Natural Resource-based Development towards scaling up work to support the low-carbon transition in energy-intensive resource-based economies. Since 2013, the Policy Dialogue on Natural Resource-based Development has offered an inter-governmental platform for peer learning and knowledge sharing where OECD and non-OECD mineral, oil and gas producing countries, all participating on equal footing, work together to

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[4] OECD Development Centre Fifth High-level Meeting of the Governing Board, Development for all: the role of domestic and international policies, Communiqué adopted on 21 May 2019, available at http://www.oecd.org/dev/HLM-Communique-may-2019.pdf .

craft collaborative and win-win solutions for natural resource governance and development, in consultation with extractive industries and civil society.

17. Within the framework of the Policy Dialogue, cost-effective solutions for the integration of renewables into mining projects were considered and efforts towards the decarbonisation of fossil fuels and the diversification of oil and gas industry portfolios were already undertaken. In addition, 10 out of 18 validated examples in the on-line Compendium of Practices (summarised in the Annex) focus on technologies for transitioning the fossil fuel industry to a low-carbon future, emission reduction in upstream operations and change of business models. Participants in the Tenth Plenary Meeting of the Policy Dialogue on Natural Resource-based Development further agreed to deepen and expand the work on revenue spending, to explore how revenues from non-renewable natural resources can finance and support the low-emission transition and deliver on the Sustainable Development Goals. The thematic dialogues to improve understanding around fiscal policy options and mechanisms that policy makers in natural resource-rich countries can use to mobilise resources, including private capital, to finance the transition will be fully integrated into the new work plan.

18. The OECD Development Centre has a distinct comparative advantage – a mandate for and experience in working with partner countries. The Centre brings together on an equal footing developing and developed economies for peer learning to facilitate formulation of tailored policy solutions, with an emphasis on practicality and replicability. The OECD Development Centre also has a unique role in translating the existing knowledge generated by the OECD into the development context, taking into account and balancing countries' varying priorities. This expertise would be particularly pertinent for advancing the agenda on the low-carbon transition, which requires adapting policy recommendations for different country contexts, to support economies in managing potential trade-offs and costs associated with the structural changes required to transition to a climate-compatible development model. This is where the Centre can add the highest value.

19. The OECD Development Centre's Policy Dialogue on Natural Resource-based Development has successfully developed guidance tools and facilitated public-private collaboration on issues related to the sustainable management of natural resources since 2013, including the *Framework for Extractive Projects on Collaborative Strategies for In-Country Shared Value Creation and the Guiding Principles for Durable Extractive Contracts*.

3 Proposed work plan for 2021-2022.

20. The present note aims to present the key issues for consideration and sets out the directions for future work to reorient the initiative towards identifying economically, shock-proof and socially viable policy options available to energy-intensive economies to transition to a low-carbon future and inform the development of transformational development strategies. It is proposed to structure the work around three pillars: (i) technology; (ii) enabling policy and instruments to incentivise the decarbonisation of energy-intensive economies and de-risk investments (iii) financing.

21. This work will build and expand upon the established Policy Dialogue platform at the level of governments, state-owned enterprises (SOEs), the private sector, civil society, think tanks and multilaterals and will bring in additional relevant stakeholders. Relevant OECD work on the energy transition, carbon pricing, green finance and reform of inefficient fossil fuel subsidies will be used to inform the dialogue process. To do so, the Development Centre will seek to mobilise available OECD expertise and body of knowledge available in the Development Co-operation Directorate, the Environment Directorate, the Financial and Enterprise Affairs Directorate, the International Energy Agency, and the Trade and Agriculture Directorate.

Developing an Inclusive Framework on a Just Low-carbon Transition for Energy-intensive Economies

22. The OECD Development Centre is committed to working towards the development of an Inclusive Framework on a Just Low-Carbon Transition for Energy-intensive Economies, based on in-depth analysis of the identified key issues for consideration, and with a view to provide concrete solutions to put energy-intensive economies on a sustainable, low-carbon development pathway. The Inclusive Framework will be developed by interested members of the OECD and its Development Centre as well as partner countries, in consultation with all relevant stakeholders, including the business community, as well as civil society. By so doing, it is expected that many different perspectives will feed into a solution from the outset and foster ownership of results to increase the chances for effective implementation.

23. The Inclusive Framework will provide action-oriented recommendations addressed to energy-intensive economies, industry and financial institutions to enable a just transition to a low-carbon economy, while seeking to minimise the risk of stranding assets or losing competitiveness. This will require well-designed policies tailored to developing and emerging economies to promote the large-scale deployment of the relevant technologies and infrastructure, taking into account potential impacts on employment and income distribution and potential barriers to their acceptance due to path dependency, informality and political economy considerations. The impacts on communities of low-carbon technologies at opposite ends of the supply chain also deserve careful consideration: upstream, at sites of extraction of critical minerals and metals, such as cobalt and copper; and downstream, at scrapyards and facilities handling their waste streams.

24. The Inclusive Framework is intended to provide a comprehensive response that takes into account the links between the three different key areas for transitioning energy-intensive economies to a low-carbon development model. A comprehensive approach should draw on an in-depth analysis of technological, policy and financing issues and how they interact. As a consequence, the Framework will

be supported by analytical work to improve understanding around available options and weigh trade-offs across the three identified issue areas.

Scoping the issues for consideration

25. In order to develop the Inclusive Framework the following interlinked issue areas will be considered: technology; enabling policies and instruments; financing.

Technology

26. Energy efficiency alone will not be sufficient to deliver the needed scale of carbon reductions and structural change in the way energy is produced and consumed. In order to significantly reduce emissions from energy-intensive sectors, the development and implementation of new breakthrough technologies such as electrification, hydrogen as a heat source and chemical feedstock, or carbon capture (utilisation) and storage (CCS/CCUS) become necessary. These technologies, however, may use more energy than conventional best available technologies (Bataillle et al., 2016).

27. It is proposed to map out available technological options for energy-intensive industries' decarbonisation to assess their environmental footprint, technical feasibility, maturity, speed of adoption in different markets, potential for deployment at scale, energy system implications and cost-effectiveness. Path dependencies due to vested interests will be considered as a critical factor influencing the choice of technological solutions. This work will also look into the possibility to treat different technological pathways as separable and the potential for lock-ins. Energy security concerns and potential for CO2 geological storage will also be taken into account as key drivers of technology choice.

28. Ways to bridge the technological divide between advanced and emerging and developing economies should also be explored, as the knowledge intensity of new green technologies may give industrialised countries a first mover advantage.

Upstream decarbonised electrification

29. Multiple upstream projects replace gas with renewable electricity. There is increasing interest in the potential for electrifying upstream operations, using electricity from centralised grid or off-grid renewable energy sources. One major driver behind this trend has been the decreasing cost of wind and solar energy, making off-grid renewables an attractive alternative source to natural gas. The use of grid-based electricity would increase the efficiency of nearly all upstream operations. The IEA estimates that just over 50 percent of global oil production today could reduce emissions from energy extraction by connecting to the power grid (IEA, 2018). The first offshore oil field electrified using an onshore grid connection was Saudi Arabia's Abu Safah development in 2003 and there 15 other offshore projects that use grid-based electricity. In order to meet climate objectives, electricity generation for industrial use would need to be fully decarbonised, but this will in turn depend on existing and potential supply of decarbonised electricity (and hence availability of renewable sources, hydrogen or synthetic hydrocarbon sourced net zero emission liquids and gases).

Hydrogen

30. Hydrogen could potentially become a substitute for natural gas as an energy carrier and heat source. Hydrogen can be made through steam methane reforming of natural gas (with byproduct CO2 to dispose of) or electrolysis of water. Hydrogen is regarded as an over-the-horizon option, given the costs of electrolysers and associated infrastructure requirements. The utilisation of hydrogen could be prioritised in sectors where it is closest to competitiveness or where there are limited alternatives. This

approach is reflected in the recent joint political declaration of the Pentalateral Energy Forum on the role of hydrogen to decarbonise the energy system in Europe. In this joint political declaration the ministers of Energy of Austria, Belgium, France, Germany, Luxembourg, the Netherlands and Switzerland have affirmed their commitment to strengthen their cooperation on hydrogen produced in a CO2 reducing manner with the aim of contributing to the full decarbonisation of the energy system. The declaration is supported by Bulgaria, Portugal, Romania and Denmark.[5]

Carbon Capture (Utilisation) and Storage (CCS/CCUS)

31. Carbon Capture and Storage consists of the pre-combustion or post-combustion separation of CO2 from fossil fuels, and its storage underground. In the CCUS variant, the captured CO2 can be used for enhanced oil recovery (EOR) as feedstock for materials or fuels. In principle, post-combustion separation of CO2 from post-combustion gases could open up opportunities for potential broad industry application. As shown in the Compendium of Practices, the Saskpower's Boundary Dam Project offers an example of a post-combustion CCS electricity generation based on rebuilding a baseload coal-fired generation unit with carbon capture.

32. In principle, low-carbon technology development, such as CCUS and hydrogen production, can rely on capabilities in large-scale engineering and project management that are a good match to those of large oil and gas companies (IEA, 2020).

Solar enhanced oil recovery

33. Solar enhanced oil recovery (EOR) can reduce up to 80% of emissions. It is a clean-energy alternative to CO2 EOR, in which the CO2 is captured from fossil fuel combustion. It involves the use of large mirrors to concentrate the sun's energy to boil water and steam. This can generate the same quality of steam as natural gas and is very attractive for countries which have a scarcity of domestic natural gas and high solar capacity, for example Kuwait, Oman and the United Arab Emirates. There is an increased interest solar enhanced oil recovery with new pilot projects that were launched in California in 2011 and in Oman in 2013.

Reducing methane emissions

34. Tackling methane leaks to the atmosphere would provide a cost-effective way to provide a significant contribution to reducing global warming. The Intergovernmental Panel on Climate Change suggests that 25% of global warming is the result of human-induced methane emissions. After the agricultural sector, the oil and gas industry is the largest source of methane emissions. Natural gas can only play a meaningful role as a transitional fuel if the industry manages to address its methane emissions. Natural gas emits less CO2 than coal or oil when used, but methane emissions stemming from production, processing and transportation challenge the climate benefits of natural gas.

Phasing out gas flaring

35. During oil production, associated gas is produced from oil reservoirsl. Much of this gas is utilised or conserved due to substantial investments to capture it. If the worldwide flared gas was turned into electricity, this would equate to more than Africa's current annual electricity consumption (Norwegian Minister of Climate and Environment, 2015). Therefore, some developing resource-rich countries such

[5] Joint political declaration of the Pentalateral Energy Forum on the role of hydrogen to decarbonise the energy system in Europe, 11 May 2020, available at https://www.permanentrepresentations.nl/documents/publications/2020/06/12/penta-declaration-on-hydrogen .

as Nigeria, Angola, Gabon, the DRC and Cameroon have taken regulatory measures, to reduce, flaring in the gas sector and fugitive emissions (ODI, 2015). Supported by enabling policies, the oil and gas industry can reduce the carbon intensity of their products by 50% over the next 30 years by phasing out routine flaring, while also contributing to increased energy affordability and security in developing and emerging economies.

Decarbonisation technologies for the mining sector

36. Globally, developing countries produce 65% of the ore required for metals production (World Bank, 2020) and the mining sector is frequently the largest emitter of greenhouse gases. A significant share of the emissions takes place at the mining stage. In the case of aluminium, the extraction of its main ingredient, bauxite, caused emissions of 818 million metric tons of carbon dioxide equivalent in 2016. The mining of iron ore corresponded to 3749 million metric tons. Emissions result from consumption of fossil fuels, mainly diesel, during the extraction itself, and during from the crushing of the ore – frequently also powered by diesel. In these countries, where each household often consumes very little energy, curbing the emissions of such large industrial emitters is likely to be critical to achieve the climate objectives under the Paris agreement. If decarbonised electricity is not available in sufficient quantity at remote mine sites, decarbonisation of mining will largely depend on decarbonized liquid motor fuels or automation.

37. Ongoing technological developments are making it technically possible to produce low-carbon metals. This includes solar and wind technology, the use of hydrogen to store energy from clean sources, and the use of CCS for the production of hydrogen. The use of hydrogen to store clean energy could solve intermittency issues associated with solar and wind power. Since metals production requires a reliable and steady energy supply, this is an important development. Such solutions are already being deployed. Ørsted has plans for developing wind-to-hydrogen-to-power solutions in Denmark, and there are operating projects in Canada and in Germany.

Enabling policies and instruments

38. To foster innovation in breakthrough technologies, attract capital investment and bring them to commercial scale, a broad mix of policies and instruments would be needed from production to end-use. The design of a fair exit strategy would also be necessary where no viable alternatives to winding down high-carbon operations exist. Such policies and instruments include energy efficiency, carbon pricing, phasing-out fossil fuel subsidies, vintage differentiated environmental regulations, innovation, research and development support policies, government procurement, energy efficiency, labelling, disclosure and reporting requirements from the supply chain, and possible trading mechanism for CO2 storage.

Energy efficiency

39. Significant amounts of energy are used to extract oil, gas and minerals from the ground, process them, and transport them to the end-user. Saving energy through improved efficiency of operations plays an important role in reconciling the goals of economic development, energy security, environmental protection and emission reduction. Available energy efficiency improvement options for mining and oil and gas industries can create quick economic returns by reducing costs along the whole supply chain with benefits for local communities, including access to energy. This can help to propel the more ambitious structural transformation agenda forward. Efficient energy options depend on the types of resources and stage of operations. For example, seismic surveying and analysis increase energy

efficiency in oil exploration through improved drilling success rates[6], while efforts to reduce gas flaring can lead to more efficient oil production. Development of alternative fuels, automation[7], renewable energy generation technologies and maintenance improvements can also lead to significant energy savings.

Carbon pricing

40. Putting a price on GHG emissions, through taxes or tradable permits, is technology neutral and encourages emitters to seek cost-effective abatement options (OECD, 2017). A carbon price may be implemented as a carbon tax, by charging a fee per unit of emissions. An alternative approach is a cap-and-trade system, where industries must purchase credits on a market or at auction in order to emit. A carbon tax results in certainty about carbon prices, but uncertainty regarding emissions from covered industries. A cap-and-trade system provides certainty about emissions from covered industries, but there is uncertainty over permit prices as they are determined in the marketplace.

41. Carbon pricing maintains the incentive to upgrade and innovate as firms try to find less expensive ways to avoid paying a price for high-carbon emissions. Exemptions granted to trade exposed sector, like energy-intensive industries, reduce the environmental effectiveness of carbon pricing and its potential to act as a driver of structural change and as a source of revenue for governments. WTO compliant carbon border adjustments can be used as unilateral measures to induce other countries to implement own carbon taxation.

42. The introduction of carbon pricing mechanisms in emerging and developing economies needs to account for the political economy of reforms and impacts on income distribution and employment, given the prevalence of informal activities and lack of or not sufficiently developed social security systems. Given the need to improve energy access and affordability in developing and emerging country contexts, a systematic review of carbon taxes is necessary to build evidence around their distributional effects, avoid regressive impacts and ensure optimal policy design to address the efficiency-equity trade-off.

Phasing-out fossil fuel subsidies

43. The fiscal impact of fossil-fuel subsidies, particularly those that keep fuels at low prices, can be large. Before Mexico embarked on its reform of gasoline and diesel price subsidies in 2014, the fiscal burden of those subsidies reached as high as 1.4% of GDP. Morocco's energy subsidies reached 5.5% of its GDP in 2011, before reforms were implemented. And in 2012, before Indonesia embarked on its recent reforms, its fossil-fuel consumption subsidies were 4.1% of GDP – four times total government expenditure on health.

44. Fossil fuel subsidies deprive governments of revenues that could be used for essential public services, or to finance economic diversification away from oil and the transition to cleaner forms of energy. At the same time, these subsidies encourage wasteful domestic fossil fuel consumption, and

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[6] See validated example in the on-line Compendium of Practices: "How to upgrade technological services for the upstream oil value chain in Kazakhstan" available at http://www.oecd.org/dev/How-to-upgrade-technological-services-for-the-upstream-oil-value-chain.pdf

[7] See validated examples in the on-line Compendium of Practices: "How can the mining sector drive growth in grid-connected renewable energy", available at http://www.oecd.org/dev/Step%204.%20Grid-connected%20solar%20in%20Chile%20(final).pdf; and "How can automation contribute to energy efficiency and reduced environmental impact in iron ore mining operations", available at http://www.oecd.org/dev/Step%204.%20Grid-connected%20solar%20in%20Chile%20(final).pdf.

lead to increased emissions of greenhouse gases and air pollution, which disproportionately affects the poor.

45. Although governments may have intended subsidies to make energy more affordable to the poor, they are in practice often inefficiently targeted and disproportionally benefit wealthier groups. Nonetheless, fossil fuel subsidies have proved remarkably hard to get rid of, partly for political reasons. Influential groups frequently exercise pressure on governments to retain these subsidies. Furthermore, the access to cheap fuel can be part of governments' social contract with citizens. Governments can mitigate some of the resistance to subsidy reform by implementing targeted support for affected poor households.

46. In the current context of the COVID-19 pandemic, fossil fuel subsidies are particularly pernicious. Severely strained health systems, and the need for economic stimulus, call for unprecedented growth in public spending. At the same time, oil export revenues have plummeted, following the demand collapse caused by the pandemic and a breakdown of traditional price-setting mechanisms.

47. Progress to phase out subsidies has in recent years been uneven. IEA tracking of subsidy-related policy announcements highlights good examples of countries, such as India, Tunisia and Egypt, with other countries announcing their intention to follow suit. However, there have been numerous examples of policy reversals or postponements – at significant fiscal and environmental cost (IEA, 2020).

48. As suggested by the IEA, what is needed in this filed is to develop a common understanding of the effects of different types of fossil-fuel subsidies, which types (and in what combinations) are the most inefficient, and what approaches to reform work best in each country (IEA, 2020a). Activities to support the elimination of fossil fuel subsidies could include sharing of best practices in countries that have succeeded, as well as analysis and discussion of the political economy of subsidy reform.

Vintage differentiated environmental regulations (VDR)

49. Governments may consider introducing stricter environmental requirements for new entrants. For example, in 2015 Canada introduced rules requiring investment in carbon capture and storage for all new coal plants, while existing plants can continue to operate unabated through to 2030. While VDRs may allow for gradual adjustment to low emission requirements, they can also slow down the uptake of low-carbon technology and reduce the competitiveness of new firms (OECD, 2017).

Innovation, research and development support policies

50. Government has an important role to play in helping to develop and commercialise new low-emission technologies. Innovation, research and development support policies are important complementary tools that can reduce cost of compliance with other policies (such as carbon pricing and emission standards), address regulatory risks and facilitate investment in capital intensive activities. Research and development support for decarbonisation should consider the legacy of prior investments that may have "locked in" old technologies, the long development times for new technologies to benefit from returns-to-scale, market risks and new energy infrastructure requirements as well as the fact that older technologies may not account for the costs of health and environmental externalities associated with their emissions.

Creating a market for low-carbon products

51. As new technologies tend to be more expensive than incumbent technologies, it would be difficult for low-carbon products to compete with traditional products on price. In order to produce low-carbon products, low-carbon alternatives to traditional products need a market to achieve economies of scale.

Government procurement of low-carbon products

52. Government procurement of industrial goods accounts for an average of 12 percent of GDP in OECD countries and up to 30 percent in many developing countries. Government procurement can thus be an effective way to help build a market for low-carbon technologies through the preferential purchase of low-carbon products. This policy can help overcome a key barrier in refining and bringing down the costs of new technologies. Public procurement can create early markets for climate friendly materials without recourse to international negotiations.

Labelling of low-carbon products and disclosure and reporting from supply chains

53. Another set of instruments available to policy makers to support decarbonisation of energy-intensive industries include approaches aiming at removing information gaps. While not reflecting all environmental costs, information-based instruments can transform markets by encouraging manufacturers to compete on new attributes (OECD, 2016).

54. Regulators can set emission standards to lower emissions from energy-intensive industries, by internalising carbon content in decision making at all stages of a material's life cycle. For example, California's Low Carbon Fuel Standard provides an example of GHG emissions associated with the production, transportation, and use of gasoline and diesel fuel. While this approach could work for emissions linked to use of fossil fuels, it would be more difficult to implement for materials, as it requires a tracing of the GHG content of all materials embodied in a product (Bataille et al., 2016).

55. Effective labelling of low-carbon products would require internationally accepted standards and certification processes for carbon content. However, there are currently no consolidated and generally accepted standards or definition for low-carbon products. With the joint political declaration of the Pentalateral Energy Forum, the ministers of Energy of Austria, Belgium, France, Germany, Luxembourg, the Netherlands and Switzerland have expressed the aim to assess the feasibility of coordinated definitions and certification or labelling for renewable and decarbonised hydrogen with regards to origin and sustainability to enable cross-border energy trade.

56. In spite of growing demand for low-carbon metals, particularly from the technology and car industries, buyers lack standardized and verifiable product information. This means that increased demand for low-carbon metals is inefficient in generating new supply of these metals. It could also lead to "greenwashing". An informal survey of metals producers, traders, and consumers, conducted by the OECD suggests that in a competitive price environment, voluntary industry action would not be sufficient to generate a broad shift of metals value chains towards a low-carbon path. There is a need for generally accepted standards to identify what a "low-carbon" metal is, as well as regulatory action to ensure the adoption of this standard.

57. Article 173-VI of the French "Energy Transition for Green Growth" law and China's requirement that all listed companies report emissions data by 2020 are two recent examples of mandating industrial decarbonisation data collection and disclosure. Disclosure and reporting requirements can also induce change in jurisdictions that lag behind as they require large corporate purchasers to report emissions from their supply chains, including foreign suppliers.

Possible trading mechanism for CO2 use and storage

58. The creation of a carbon market through the facilitation of transboundary transport of carbon dioxide could generate demand for CO2 use and storage through a trading mechanism. While enhancing efficiency, this could create an additional revenue stream that would facilitate the uptake of this technology in resource-rich developing and emerging economies where it is not yet utilised.

Financing

59. Financing the low-carbon transition remains a major challenge for energy –intensive economies. To achieve low-carbon and climate resilient development on a global scale, it is estimated that 6.9 trillion USD of investments per year will be needed, of which 3.9 trillion USD is required in developing countries. The investment gap for developing countries, or difference with the current level of around 1.4 trillion USD, is estimated at 2.5 trillion USD per year. By comparison, total official overseas development assistance in 2018 amounted to 153 billion USD, or about six percent of the investment gap for developing countries. Since many governments are fiscally constrained, it is clear that the majority of this investment will need to come from other sources. However, transition-related government expenditures will need to be balanced with the allocation of resource revenues to other development objectives.

60. This work will build on the key policy recommendations resulting from the OECD Development Centre's policy guidance on using extractive revenues for sustainable development (OECD,2019) and the analysis of the role of work on sovereign and strategic investment funds in the low-carbon transition (OECD, 2020). Mechanisms to mobilise and free-up resources to support the transition of energy-intensive industries to a low-carbon future include revenue recycling, development finance and investment strategies of state-owned enterprises.

Revenue recycling

61. Carbon pricing generates government revenue that can be channelled in a manner that increases the social acceptance and take into consideration the political economy and social impacts of tax reforms in developing and emerging economies. Little evidence is available on how the revenues from carbon pricing are or should be used in such contexts. Building on relevant OECD work (OECD, 2014; Flues, F. and K. van Dender (2017), it is proposed to better understand how such revenues could be put to productive use in emerging and developing economies to alleviate poverty, increase energy access and affordability and compensate for the potential regressivity of carbon taxation.

Development finance

62. While multilateral banks, donors and long-term investors have shifted away from financing high-carbon sectors, there has been little debate on how development finance can or should contribute to reducing the carbon footprint of energy-intensive industries, by supporting the deployment of low-carbon technologies.

63. Development finance providers could consider financing projects that focus strictly on emissions outcomes, instead of a sector-based curtailing of financing for the fossil fuels sector.

Investment strategies of state-owned enterprises

64. State-owned enterprises (SOEs) remain an important player in the global energy market, including in the OECD countries, accounting for 61% of total electricity capacity installed in 2016, and 52% in the pipeline at that time. Resource-rich countries often use SOEs to maintain a degree of control over the extraction and production of natural resources, including fossil fuels, which are of particular strategic and economic value, generating additional government revenues besides taxes and royalties.

65. For this reason, SOEs constitute an important vehicle for governments to direct revenues from their extractive sector into financing the low-emission transition. Emerging empirical evidence points to a positive impact SOEs may have on investments into renewables (Prag et al., 2018). Further research is required to better understand the role of state ownership in the transition and the effectiveness of different policy levers available to governments to drive SOEs' green investment.

4 Proposed output results

66. Subject to funding availability, the work on the low-carbon transition of energy-intensive economies will be structured around four main components: a) a dialogue platform for trust-building, mutual learning and collaborative solutions; b) evidence-based analysis to build a common knowledge base to improve understanding of available options and associated trade-off; c) provision of guidance through the collective development of an Inclusive Framework to put energy-intensive economies on a sustainable low-carbon development pathway; d) the identification of pressure areas requiring enhanced collaboration and international co-ordination. This could eventually lead to the development of a set of actions and instruments to better align environment, climate, economic and social policy objectives.

Dialogue platform for mutual learning and collaborative solutions

67. The dialogue platform will identify and discuss policy options and trade-offs to support an inclusive and just transition to a shock-proof sustainable global low-carbon economy.

68. The Dialogue will offer a safe space for trustworthy interactions among different constituencies. A necessary pre-condition for knowledge sharing is framing a common problem and enabling access to knowledge, by bringing in multiple perspectives. This process will support the development of newly collective knowledge paving the ground for operational solutions to commonly identified issues. The knowledge sharing and peer learning exercise is necessary to fill knowledge gaps, better understand the issues in question, and progressively build trust across different constituencies.

69. The co-production of knowledge and mutual learning will serve as a transformative process resulting in innovation for all parties involved, with new tools developed through mutual learning and collaborative innovation. The appropriate degree of diversity and complementarity in the range of participants with both relevant technical expertise and political leadership aims to ensure that many different perspectives feed into a solution from the outset and foster ownership of results to increase the chances for effective implementation.

Evidence-based analysis

70. Subject to funding, the OECD Development Centre will produce evidence-based analysis to support the dialogue process, build a common knowledge base and collect evidence on: (i) fiscal and other mechanisms to incentivise energy-intensive industry decarbonisation; (ii) Technological solutions for the low-carbon energy transition; (iii) filling the investment and financing gap, including through revenue recycling, state-owned enterprises' investment strategies, and development finance.

71. The planned analytical work is intended to support peer-to-peer learning and sharing of best practice examples on how to incentivise the decarbonisation of energy-intensive industries, de-risk investments, and overcome political economy and market barriers to scaling low-carbon solutions.

Inclusive Framework on a Just Low-Carbon Transition for Energy-Intensive Economies

72. The evidence-based analysis will inform and support the development of the Inclusive Framework on a Just Low-carbon Transition for Energy-intensive Economies. The Framework is intended to provide a blueprint for action to assist policy makers in designing comprehensive strategies to advance the low-carbon transition, while accounting for potential adverse impacts on workers and communities. The objective is to offer a combination of policies, instruments and mechanisms that simultaneously delivers innovation and investment in low-carbon solutions and address associated social, economic and cross-border impacts.

Pressure areas for enhanced international co-operation

73. It is expected that the planned analytical work and the guidance framework will also lead to the identification of pressure areas where enhanced international co-operation would be necessary to effectively advance the low-carbon agenda and bring about the required structural change of how energy is produced and consumed. A global strategy would be needed to achieve the desired objectives in such highly traded industries.

74. International co-operation and co-ordinated action would be required to steer and accelerate structural change and technological transitions in energy-intensive economies, simultaneously achieve climate, economic and social objectives, and avoid the risk of carbon leakage with the relocation of high-carbon activities in less stringent jurisdictions. For example, the OECD found that the potential of carbon pricing is far from being realised as there is no experience to date of jurisdictions agreeing to a common carbon price level using taxes (OECD, 2017). Levelling the playing field would be the most efficient and effective way to ensure global coordination of carbon pricing, thus eliminating the risk of carbon leakage with the potential relocation of high-carbon operations to unregulated countries. Such an endeavour would be worthwhile even in a scenario of structural low oil prices to avoid a possible rebound in fossil fuel demand in the future.

75. Inspired by the OECD BEPS project, this work may eventually lead to the collective development of a set of actions, providing an internationally co-ordinated approach to the low-carbon transition that may satisfactorily respond to outstanding issues regarding the cross-border impacts of low-carbon solutions.

76. The OECD (OECD, 2017) has already formulated the following relevant recommended actions, which already provide a good basis on which to build a comprehensive set of actions that deal with all relevant aspects of the low-carbon transition of energy-intensive economies:

- Accelerate the reform of inefficient fossil-fuel subsidies that encourage wasteful consumption, including agreeing on a date for phasing out such subsidies. As the basis for reform, expand internationally comparable information on subsidies to more countries and types of support, for example through peer review. Share experience on successful and progressive subsidy reforms.
- Broaden the carbon pricing base, track impact and emissions reductions progress, and share policy experience of effective carbon pricing to inform flexible forward-looking policy decisions. Explore joint action in this area, such as minimum carbon prices, gradual increases in prices over time, and linking of emissions trading systems.
- Make greater use of public procurement to invest in low-emission infrastructure and to trigger industrial and business model innovation through the creation of lead markets, for example by introducing climate-related criteria to procurement decisions.

- Implement and strengthen research, development and demonstration efforts for breakthroughs in technologies essential for eliminating GHG emissions from industry and from road, maritime and air transport, as well as breakthroughs in energy storage and "negative emissions" technologies, including through international collaborative efforts such as Mission Innovation.

77. Taking the BEPS Action Plan as a model, further work would be needed to (i) expand and refine the set of recommended actions needed to enable a just low-carbon transition in energy-intensive economies; (ii) provide countries with instruments, domestic and international, aiming at providing the right incentives to enable the low-carbon transition; (iii) set deadlines to implement these actions and (iv) identify the resources needed and the methodology to implement these actions.

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Annex A.

OECD Compendium of Practices – Summary of validated examples on transitioning energy intensive industries to a low-carbon future

How can solar energy support more efficient enhanced oil recovery: In Oman, solar thermal energy was harnessed directly to convert water into steam for enhanced oil extraction, reducing the use of natural gas leading to financial savings and making natural gas available for other productive purposes.

How can mining catalyse the deployment of off-grid energy: In Australia, the mining company Sandfire partnered with a renewable energy company to augment its off-grid diesel power generation with a solar photovoltaic and battery hybrid system. Integrating a hybrid solar power and battery set-up reduced the use of diesel that needed to be trucked into the remote location and enhanced stability by smoothing out power fluctuations.

How can the mining sector drive growth in grid-connected renewable energy: In Chile, the mining company Collahuasi was a pioneer in contracting grid-connected solar energy to support its copper mining operation. Chile's power generation used imported fossil fuels with high fluctuating prices while solar energy offered a stable, guaranteed long-term price through a power purchasing agreement.

How can industry adapt operations to meet changing demand for minerals driven by the uptake of low-emission technologies: This example from Australia, an important lithium and nickel producer, considers how in the context of the global low-carbon transition, extractive companies are reorienting operations towards minerals with increased demand driven by the trends towards electric vehicles. It shows that while there is clear intent to see the world transition away from fossil fuels towards greener technologies, generating shared value from the minerals and metals depends on effective collaboration between government and industry. In this context, state governments in Australia have played an important role in incentivising downstream processing and upgrading the role of the country as a strategic supplier of these critical minerals.

How can automation contribute to energy efficiency and reduced environmental impact in iron ore mining operations: For Rio Tinto, the energy used to power its operations, coming predominantly from fossil fuels, contributes to more than 90% of the company's total greenhouse gas emissions. This example from the Pilbara mine in Western Australia shows that technological innovation through automation has the potential to reduce fuel consumption in mining operations by 10-15% through greater fuel efficiency. Requiring fewer stops and manoeuvres, automation can lead to increased outputs as well as decreased maintenance costs. Combined, these factors demonstrated a clear business case, while also offering means to align resulting efficiency gains with the company's strategy to meet GHG emissions targets.

How can host countries benefit from increased demand for minerals driven by the low-emission transition: South Africa's HySA programme, an initiative to develop hydrogen fuel cell technology capabilities – a family of technologies that uses chemical reactions rather than combustion to generate energy, electricity and heat, and which leverages the country's substantial reserves of platinum group metals. This example does not only show how to generate linkages from the country's mining sector but also how to connect this objective with the transition away from fossil fuel-based domestic power generation. While mobilising resources and greater private sector participation remains a challenge for the programme, the collaborative approach to R&D not only brought industry and research institutions into the 15-year initiative, but sought alignment across policy areas, including with the National Climate Change Response Strategy, helping to create a mutually reinforcing and supportive policy environment.

<u>How to upgrade technological services for the upstream oil value chain in Kazakhstan</u>: The oil and gas sector in Kazakhstan has mostly exported primary products with little value addition. As part of the collaborative exercise between the government, industry and research organisations on developing the "Kazakhstan Upstream Oil and Gas Technology and R&D Roadmap", participating stakeholders concluded that there was room for well-targeted strategies. At the end of this road-mapping process, the industry, in collaboration with government, identified areas of linkages for local R&D, value addition and upgrading. Based on the country's interests and the specific business need identified by industry, Shell and the state-owned oil company KazMunayGas launched the Geochemical Centre of Excellence in Kazakhstan. Due to the proliferation of high technology and targeted specialised training, the geochemical laboratory contributed to improved field economics and reduced environmental consequences of drilling. The geochemical laboratory enables Kazakhstan and the oil and gas industry to discover new hydrocarbon reserves and reduces the price of oil exploration activities.

<u>How to reduce water consumption and high emissions from coal chemical plants through the deployment of CCUS technology for enhanced oil recovery in China</u>: Yanchang Petroleum carried out a pilot project on CCUS technology to achieve CO2 recycling and low-carbon production with the support of the Chinese National Development and Reform Commission and Ministry of Science and Technology as well as the Asian Development Bank and other international partners. There was alignment between PRC's policy objectives and Yanchang Petroleum Group's interest to deploy a cost-effective CCUS solution to reduce the high CO2 emissions and water consumption rates associated with its coal to chemicals (CTC) projects in the Shaanxi Province in North West China. This was done by gradually replacing water flooding with CO2- enhanced oil recovery technology, thus also increasing oil production in a series of mature oil fields in the Ordos Basin. The Yanchang Petroleum Group considered CCUS as a cost competitive technological solution, given the proximity of the CCUS facility to the different oilfields in the same area, achieving economies of scale. Compared to water flooding, CO2-EOR was regarded as a more sustainable solution, from both an environmental and economic perspective, addressing the double challenge of emission reduction and water consumption.

<u>How carbon taxation can help deploy CCS in natural gas production</u>: In 1990, during the planning phase of the Sleipner project, located in the Norwegian part of the North Sea, it became clear that the natural gas contained about 9% of CO2, exceeding customers' specifications of a maximum 2.5% share. Therefore, the CO2 content needed to be reduced before natural gas could be sold. Rather than venting the separated CO2, Equinor, the operator of the field, decided to invest in CCUS technology. In 1991, the Norwegian government introduced an offshore CO2 tax as an effort to reduce emissions. This tax would have applied to any CO2 that was released from gas extracted from Sleipner. The CO2 tax was one of the triggers for operator Statoil's plans to separate CO2 offshore and inject it into deeper geological layers. Due to the Norwegian CO2 emissions tax, is became more economical to store the CO2 once captured than venting it.

<u>How to decarbonise a coal-fired power plant</u>: In conventional coal-fired electricity generation, large amounts of CO2 are produced during combustion of the fuel in air, but only as a small fraction of the flue gas stream. Separating CO2 from the other flue gases after combustion of the fuel is more expensive. The first large-scale project in which CO2 was separated from power station flue gases is the Boundary Dam (Unit 3) Carbon Capture and Storage project in Saskatchewan, Canada, which commenced operations in 2014. The Boundary Dam CCS Project rebuilt a 115 megawatt coal-fired generation unit with carbon capture technology capable of reducing GHG emissions by up to 1Mtpa of CO2 each year. The captured CO2 is sold and transported by pipeline to nearby

oil fields in southern Saskatchewan where it is used for enhanced oil recovery. CO2 not used for enhanced oil recovery is stored in the Aquistore project, a research and monitoring project, which analyses the effects of storing CO2 deep underground in a layer of brine-filled sandstone. Canada was among the first countries to make laws on emission reduction from coal-fired power plants. In 2011, the federal government announced strict performance standards for new coal-fired units and units that have reached the end of their useful life. The capture technology enabled the project operator, SaskPower, to meet these standards, while selling CO2 for enhanced oil recovery providing a revenue stream to help offset the added cost involved in carbon capture. The project received CAD 240 million in capital support from the Canadian government.