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## **Improved competition, innovation and finance for bioenergy development**

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Colombia has implemented a number of measures to increase the attractiveness of the country's investment environment, which has enabled increasing levels of private capital to be mobilised for renewable energy developments in recent years. Yet, investment in bioenergy projects, which struggle to compete with fossil fuels and the diminishing costs of solar and wind, remains limited. This is compounded by limited local technical expertise to implement projects and perceptions of risks by financial actors regarding bioenergy technologies and the stability of revenue streams from these additions. Addressing these issues requires efforts to increase awareness and familiarity with bioenergy solutions whilst improving overall access to finance, for instance by extending public support and development funds to de-risking tools for bioenergy projects. Use of capital market instruments like green bond issuance can also help to unlock affordable finance for bioenergy projects and to increase the investor base for clean energy solutions in Colombia.

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## Highlights

- Competition with fossil fuels, low landfill fees and diminishing solar and wind costs have made it challenging to attract finance and investment for bioenergy projects. Supporting these capacity additions requires targeted measures to facilitate their access to market, including possible design elements in renewable energy auctions that attract smaller players or that reward projects based on criteria such as location and system friendliness.
- Bioenergy solutions can boost productivity and competitiveness, as has been the case with sugarcane and palm oil cogeneration additions. Awareness raising, capacity building and support for innovation will help enable local technical expertise and unlock opportunities for suitable bioenergy technologies, such as biodigesters for small-scale applications.
- The cost of finance for bioenergy technologies can often be high, due in part to limited local experience, unfamiliarity with these projects and overall perceptions of risk by financial actors. Finance for projects can also be a challenge given the creditworthiness or lack of credit history of smaller borrowers, in addition to difficulties in demonstrating a clear revenue stream. Work with financial partners like Bancolombia, Bancoldex and Finagro can build upon existing concessional credit lines to raise awareness and capacity for bioenergy project development.
- Colombia has several funds designed to support clean energy projects, mostly in the form of grants, which limits the number of projects that can be supported. Applying these funds more strategically, for instance through de-risking tools such as guarantees and credit enhancement, can encourage more active participation of private capital for bioenergy solutions. The government can also work with multilateral and international funds to design blended finance mechanisms that can catalyse private finance for bioenergy development in Colombia.
- The capital market is not a significant source of funding for clean energy projects in Colombia but represents an untapped opportunity to increase long-term, affordable financing. Support for the early design and use of capital market instruments like green bond issuance can help unlock access to these markets and deepen the investor base for clean energy development.

Colombia has taken a number of measures to increase the attractiveness of its investment environment since the 1990s, and the country ranked 57<sup>th</sup> (out of 141 countries) in the World Economic Forum's 2019 Global Competitiveness Report (Schwab, 2019<sup>[1]</sup>), up from 68<sup>th</sup> in 2010 (Schwab, 2010<sup>[2]</sup>). Colombia's stable macroeconomic situation, its large internal market and its growing, dynamic business environment (each respectively ranked 43<sup>rd</sup>, 37<sup>th</sup> and 49<sup>th</sup>) have all helped to encourage investment in a number of critical sectors, including in clean energy development. Trade agreements, including 13 bilateral deals such as those with Canada (2011), the United States (2012), the European Union (2014) and South Korea (2016), have also increased the country's economic attractiveness.

Private investment in non-conventional renewable energy (NCRE) has continued to increase in recent years, driven in particular by attractive tax exemptions, updated regulations on bilateral contracts and the 2019 renewable energy auctions. Still, Colombia will need to attract greater amounts of capital, including from foreign sources, to realise its clean energy ambitions over the next decade and beyond. There remains ample opportunity to increase investment in clean energy projects and President Ivan Duque Marquez announced in March of 2021 that government would accelerate reforms to attract foreign direct investment (FDI) in clean energy generation (Espejo, 2021<sup>[3]</sup>). This is a positive affirmation of the country's determination to unlock its renewable energy potential, though achievement will hang on engagement of the private sector, including commercial and industrial users that account for more than half of Colombia's electricity demand (Morganstein et al., 2021<sup>[4]</sup>). Many of these large companies have already started to

invest in clean energy solutions, as evidenced by bioenergy cogeneration in the sugar and palm industries and more recent corporate rooftop solar procurement.

This engagement of private capital, all the same, can improve considerably and investment in bioenergy, which currently is limited mostly to industry financing of cogeneration projects, does not reflect technical opportunities and political ambitions highlighted by the government. Competition with fossil fuels and low landfill fees, even in light of measures like the landmark 2014 Renewable Energy Law, have made it challenging to attract finance and investment for bioenergy projects. This is compounded by recent competition with diminishing solar and wind costs under the Planning Unit of the Ministry of Mines and Energy (Unidad de Planeación Minero Energética, UPME) renewable energy auctions, whose price per kilowatt produced does not readily reflect the broader socioeconomic value of bioenergy capacity, nor the opportunities for those additions to be used for other energy vectors (e.g. biogas and biofuels). Limited experience with some bioenergy solutions, such as agricultural biogas projects, also means that effort is needed to support capacity building, technical skills, technology development and/or adaptation to unlock these untapped opportunities.

Improving this situation will require a more competitive market framework with improved access to affordable finance and greater support for innovation. For example, improved transparency in the UPME project registry and connection approval process will help to encourage greater participation of bioenergy projects. Targeted procurement of bioenergy development, for instance for local electricity generation capacity improvements, including in non-interconnected zones (zonas no interconectadas, ZNI), under the provisions under Law 2036 of 2020 to support territorial development of NCRE, can equally help to create a clear pipeline of new projects. Awareness building and technical training (e.g. for installation and operation of bioenergy technologies with local industry and farmers) will also increase capacity for project development. These types of actions will help to build upon existing regulatory measures and incentives to level the playing field for new bioenergy projects, whilst improving the interest and ability to deliver “bankable” project proposals and viable business models that are “investor ready”.

## Fair market competition will improve the business case for bioenergy projects

Colombia’s unbundled electricity market allows for private investment across the sector’s activities and multiple actors contribute to generation, transmission, distribution and retail services. Electricity market reforms since the mid-1990s helped to introduce competition in the sector and foreign investors can also participate in the market, receiving the same treatment as Colombian nationals. In particular, FDI in electricity generation has very low restrictiveness, even if some issues remain, for instance the efficiency of the legal framework for dispute resolution (OECD, 2021<sup>[5]</sup>).

At the same time, the national electricity market has nonetheless struggled to provide a reliable supply of electricity under competitive conditions (World Bank, 2019<sup>[6]</sup>). Events like the 2016 El Niño crisis also have meant that consumers have faced significant price volatility where for example commercial and industrial electricity rates varied as much as 55% and 35% over 2010 tariffs (Morganstein et al., 2021<sup>[4]</sup>). In addition to structural weakness like the 2016 reliability market failures, market power also remains quite concentrated. Notably, more than 60% of generation capacity is owned by four actors (i.e. Emgesa, ISAGEN, Energía del Pacífico and the publicly owned company, EPM) who also participate in other electricity market activities.

Three additional companies control a further 16% of generation capacity and also have stakes in transmission, distribution and retail activities. The 2020 failure and liquidation of Electrocaribe (a large distribution company) meant that 68% of distribution is likewise owned by three firms (EPM, Condesa and Celsia). This concentration, alongside continued price volatility, illustrates that the unbundling of electricity market activities did not necessarily address the strong vertical and horizontal integration of the market, which in turn influences overall competitiveness and can discourage new actors. Market concentration

problems (e.g. abuse of market power during tight demand-supply conditions) have also led to distorted tariffs and spot and contract prices (World Bank, 2019<sup>[6]</sup>).

### ***The wholesale market is open, but options are limited for some bioenergy projects***

2018 reforms by the Superintendence of Industry and Trade (Superintendencia de Industria y Comercio)<sup>1</sup> helped to improve the overall, competitive framework for investments, for example by increasing investigations into bid-rigging with consequent sanctions. Ministry of Mines and Energy (Ministerio de Minas y Energía, MME) Decree 570 of 2018 and its power purchase agreement (PPA) guidance also helped to enable new electricity market entries, where notably, long-term contract mechanisms were previously a significant barrier to renewable energy additions. Specifically, bilateral contracts between generators and retailers often took the form of a take-or-pay contract, typically with a short duration of one or two years (World Bank, 2019<sup>[6]</sup>).

MME Decree 570 of 2018 addressed this by allowing generators to participate in the wholesale market via short-term and long-term transactions through firm energy obligations (under reliability auctions), in bilateral contracts or via the spot market. Bilateral contracts in particular have worked well for utility-scale additions such as those signed under the 2019 and 2021 renewable energy auctions, which helped to draw in foreign investors, who represented over half of the participant awards. The utility-scale bilateral agreements also helped retailers to fulfil their renewable portfolio requirements (see regulatory section above) by securing sizeable PPAs with typically large and experienced players. In fact, awarded contracts in the 2019 auctions were only capacities above 75 MW, even if the capacity floor for bids was set at 5 MW.

Technically, bilateral contracts with smaller players and generation sizes are possible, but these can be challenging, especially for less established actors. This is particularly the case for opportunities to engage with unregulated customers, who can only contract via a single retailer under Energy and Gas Regulation Commission (Comisión de Regulación de Energía y Gas, CREG) Resolution 131 of 1998.<sup>2</sup> This effectively requires smaller generators to find a retailer willing to act as the conduit to supply electricity to unregulated customers. Additionally, the retailer also needs to agree to provide the customer's remaining electricity needs, should the generator not have sufficiently installed capacity (Morganstein et al., 2021<sup>[4]</sup>). It is therefore easier for larger generators to negotiate these types of bilateral contracts, especially if they have integrated retail activities, allowing them to contract directly with unregulated customers.

Beyond bilateral agreements, another option is for generators to sell their electricity directly in the spot market. This can include self-generators, as long as they are connected to the grid and are above 2 MW, as well as distributed generation projects that are over 20 MW. This option can work well for generators with existing surplus capacity (e.g. in industry cogeneration) and can even compliment bilateral contract agreements (see Annex A on sugarcane cogeneration in Colombia). Yet, the spot market by itself does not provide sufficient visibility in medium- to long-term pricing (nor eventual demand) to justify capital expenditures for new capacity additions, as price predictability not only is critical to justify upfront capital needs but also helps to hedge against potential operational fluctuations (e.g. in feedstock prices for biogas generation). Given retailer preferences for bilateral contracts with larger utility-scale additions, this gap between the spot market and PPAs effectively leaves smaller-scale projects in a challenging space to secure a clear revenue stream.

Firm energy obligations, by comparison, can provide more attractive terms for such projects, as the obligations include a stable reliability payment in USD over a 20-year period. Yet, the firm energy auctions by themselves may not provide sufficient revenue to attract new capacity additions. Additionally, incumbent actors' concentration in the generation market gives those companies a natural advantage and firm energy auctions have consequently lacked competition (World Bank, 2019<sup>[6]</sup>). This was evident in the price spikes of 2016, where greater inclusion of renewable energy in the reliability charges would have improved generator diversity and taken pressure off fossil fuels (particularly natural gas) in tight supply conditions.

Overall, the 2018 reforms may have opened the electricity market to new actors and foreign investment, but entry for smaller actors and generation projects is still challenging. This applies to bioenergy projects, which in addition to competing with solar and wind prices in the renewable energy auctions also lack a clear pathway to sales in the wider wholesale market. Efforts to create a more level playing field for all types and size of generators will therefore be critical to improving the business case for investment in bioenergy projects.

### ***Use of more targeted measures can facilitate bioenergy access to market***

One possible way to address this is to revisit design elements used in renewable energy auctions in order to support greater participation of bioenergy bids in future rounds. For example, buyers and sellers under the 2019 auctions had to submit commitment bonds as financial guarantees, where specifically sellers had to present a performance bond (garantía de cumplimiento) and a start-up guarantee (garantía de puesta en operación). These types of guarantees are commonly used to ensure an auction's success and to discourage underperformance of projects (IRENA and USAID, 2021<sup>[7]</sup>). Yet, stakeholders indicated after the first auction in February 2019 that the bond amounts for bidders were too high and could be difficult to obtain, especially on short notice. The amounts were subsequently lowered in the October 2019 and 2021 auctions, but they may still be a barrier for some bioenergy projects (amongst others), particularly where bioenergy technologies or applications have limited demonstration in the Colombian context and as a result may have difficulties obtaining necessary guarantees.

To address this, the government could consider acting as the guarantor of certain types of bioenergy projects (e.g. biogas capacity additions from agricultural or municipal waste streams). Future renewable energy auctions could also target design elements to attract smaller players, for instance by establishing winner selection criteria that compensate new and/or small developers beyond their pricing offers (IRENA and USAID, 2021<sup>[7]</sup>). Auction design could also include pricing that incorporates elements like a locational component, which is a feature in renewable energy auctions in Mexico, thereby increasing or decreasing the value of a bid depending on system friendliness. This has meant that even if some bid prices were more expensive, projects could still be selected over other less expensive ones if they had more value for the system (e.g. because the project was located in a place of power scarcity) (OECD, 2021<sup>[8]</sup>).

Future auctions could likewise apply criteria to reward projects based on their target bioenergy projects specifically (Box 4.1). For example, the government of Brazil announced in December 2020 that it would hold an auction specific to waste-to-energy projects in 2021 (ABREN, 2020<sup>[9]</sup>). Indonesia similarly held auctions for three waste-to-energy projects in 2019 and 2020, with further plants to develop 12 such generation plants (Lim, Yuen and Bhaskar, 2021<sup>[10]</sup>). These projects will help tap into large potential for bioenergy production and address challenges with price competition with other renewable energy sources.

Other procurement approaches such as public-private partnership (PPP) models can also help bioenergy developers to enter the market in light of current challenges to secure bilateral agreements with retailers (RVO, 2021<sup>[11]</sup>). For example, support for design-build-own-operate agreements through publicly owned utilities (e.g. EPM) could help bioenergy developers to access the market and demonstrate the value of these additions, whilst also supporting the projects to overcome other critical barriers, such as obtaining affordable financing without a clear pathway to a longer-term contractual agreement. These types of contractual structures can likewise be encouraged with private retailers, either through targeted support (e.g. fiscal incentives for retailers) or even specific portfolio requirements within current portfolio rules.

### Box 4.1. Promoting bioenergy development through targeted auctions in Brazil

Bioenergy solutions can play an important role in meeting Brazil's growing electricity needs, given substantial agricultural and municipal waste streams in the country. For example, the country's local waste-to-energy association, Abren, identified as much as 5 GW of waste-to-energy capacity potential, which could meet up to 8% of national electricity demand. Unlocking this potential would require investment of around USD 30 billion (160 billion Brazilian real). Yet, as in many other countries, these potential bioenergy solutions have struggled to attract investment, given competition with other electricity generation sources and more recent renewable energy auctions, whose price schemes have not directly reflected the value added from improved waste management.

To enable development of these opportunities, Brazil's National Electricity Regulatory Agency (Agência Nacional de Energia Elétrica), tailored the design of its power generation auction in 2021 to help procure bioenergy capacity additions. This new bidding process was open to wind, solar, hydro and bioenergy projects (thermal plants using sugarcane bagasse, wood chips and solid urban waste) as well as coal and natural gas capacity. Yet, different price caps were applied by technology or groups of technologies, allowing for competition within these categories. Winning generators signed contracts directly with distribution companies, and PPAs will come into effect in January 2026.

The new auctions provided a specific price cap for waste-to-energy technologies, allowing these to compete against each other. The cap for solid waste projects was set to USD 118 per MWh, compared to the price set for wind and solar at USD 35 per MWh. Other bioenergy technologies such as sugar cane bagasse and wood chips fell within the thermal category, with a price cap of USD 67 per MWh. Additionally, while contracts for wind and solar secured 15-year terms, bioenergy and waste-to-energy plants were awarded 20-year contracts.

The newly designed auctions were held on 30 September 2021 and 861 MW of renewable energy projects were awarded at an average price of USD 44 per MWh. Within these newly secured PPAs, bioenergy projects were awarded the largest additions, securing 321 MW of future capacity.

In the face of recent hydro shortages, the government of Brazil also took the decision to hold a thermal auction for Brazil's capacity reserves. 132 energy projects (both new and existing) will compete for 51 GW of awarded contracts in the auction planned for December 2021. Natural gas accounts for the majority of bids, though a notable share of bioenergy projects are also in the running (amongst other technologies). In total, 437 MW of bioenergy capacity is registered to participate, including biofuels (269 MW), sugarcane bagasse (80 MW), municipal solid waste (45 MW), wood chips (25 MW) and biogas (18 MW).

This impressive shift in bioenergy projects participating in Brazil's energy auctions illustrates that tailoring procurement design (e.g. through technology specific price caps) can encourage participation of underrepresented technologies and increase contract awards to those projects. This targeted approach also helped to improve price discovery through narrower competition across project types.

Sources: (ABREN, 2021<sub>[12]</sub>); (REGlobal, 2021<sub>[13]</sub>); (Renewables Now, 2021<sub>[14]</sub>); (Renewables Now, 2021<sub>[15]</sub>); (BNAmericas, 2021<sub>[16]</sub>)

## Innovation and capacity building can improve the business case for bioenergy

Colombia has an overall attractive investment environment, although there remain some challenges in attracting greater levels of private capital, including for clean energy development due to issues regarding productivity, given high levels of informality in parts of the country's economic structure (OECD, 2019<sub>[17]</sub>).

This includes low productivity undermining the agricultural sector's competitiveness and innovation capacity, which indirectly affects the attractiveness of investment in bioenergy solutions.

Short-term responses to problems faced by the sector have tended to focus on input subsidies, although a recent 2019 policy on contract farming did promote a longer-term linkage between small-scale producers and markets, for example promoting alliances between the agricultural and industrial sectors (OECD, 2020<sup>[18]</sup>). Additional measures targeting strategic investment in the sustainable development of the agricultural sector (e.g. strengthened policy regarding spending on innovation and advanced bioenergy technologies) would benefit related bioenergy capacity, such as anaerobic digestion technologies.

There equally is extensive opportunity to develop clean energy solutions that would boost overall industry sustainability and competitiveness in Colombia, for instance through bioenergy applications like the cogeneration capacities developed in the sugar and palm industries. Investment in these types of solutions remains limited across the various industrial sectors, reflecting wider market issues with respect to productivity and innovation in industry and agriculture (OECD, 2014<sup>[19]</sup>). Lack of familiarity and expertise amongst industry actors, for example for implementation and use of bioenergy technologies, also contributes to this weak deployment and requires further technical competence (RVO, 2021<sup>[11]</sup>).

These issues of low innovation and technical capacity were highlighted in the 2018 Green Growth Strategy, which subsequently prioritised actions to support science, technology and innovation, as well as the development of human capital to support green growth. Notably, the report highlighted that investment in science, technology and innovation is low (around 0.7% of GDP in 2016), and spending on innovation by the private sector is very low, with 54% of these investments between 2006 and 2016 coming from the public sector (DNP, 2018<sup>[20]</sup>). By contrast, around 70% of spending on research and innovation in OECD countries is made by the private sector (OECD, 2020<sup>[21]</sup>).

Increased investment in innovation can improve the business case for bioenergy projects in Colombia, including through development of cost-effective solutions that are adapted to the specific needs or context of the local application. For example, imported technology solutions may not be adapted to specific industry conditions or operating contexts (e.g. for use in small poultry and dairy farms). Development of suitable technologies (e.g. biodigesters for micro- and small-scale applications) will enable greater opportunities for bioenergy use in those industries. Investment support can equally target capacity building for local bioenergy production, for instance through domestic pellet production using lignocellulosic waste from industry and agriculture, which could be used as a substitute for fossil fuel thermal power generation. Innovation can also target solutions such as new business models to sort and treat various forms of waste.

Support is also needed to develop technical expertise, as local industry and agricultural actors can be unfamiliar with the installation, operations, maintenance, repairs and replacement of bioenergy technology. Awareness raising, alongside training and capacity building, can help to address these issues, whilst equally helping to identify and develop cost-effective solutions for local bioenergy projects, as those actors are more familiar with the operational application and technical needs. Support for local technical capacity will also help to increase economic productivity, as illustrated by the projects supported by the "Biovalor" initiative in Uruguay (see clean energy solutions above).

Innovation and capacity building efforts to enable bioenergy solutions in Colombia can build upon previous initiatives such as the 2014-18 national agenda for competition and innovation (Agenda Nacional de Competitividad e Innovación<sup>3</sup>). For example, the recently established Center for Industrial development (Centro de Desarrollo industrial, CENDI) can support innovation for bioenergy technologies by bringing together stakeholders and piloting bioenergy solutions for industry in Colombia. Engaging authorities such as the National Commission for Competition and Innovation (Comisión Nacional de Competitividad e Innovación<sup>4</sup>) and the national business and entrepreneurial promotion agency, iNNpulsa, can also help to encourage innovation for bioenergy solutions. These actors and initiatives can likewise support training, coaching services and other capacity building exercises to enable deployment of bioenergy technologies and business solutions in industry and other relevant sectors (e.g. agriculture).

The government can also consider the role of PPP models to enable bioenergy technology research, development, demonstration and deployment, for example through programmes supported by the Ministry of Science, Technology and Innovation (Ministerio de Ciencia Tecnología e Innovación). These can help to encourage private sector investment in bioenergy solutions in early market stages or where there is limited market experience, whilst enabling greater national expertise in solutions that can more efficiently (re)utilise Colombia's abundant waste resources for energy production.

Limited public resources can also be used to support critical stages of clean energy solutions and business ventures, for instance through targeted coaching and business development support. These targeted measures can help to ensure successful innovation, start-ups and scale-up of clean energy solutions, as has been the case in other countries (Box 4.2). They can also spur greater development of domestic supply chains and clean energy entrepreneurs, for instance helping firms to overcome the “valley of death”.

#### Box 4.2. InnoEnergy services through the European Institute of Innovation and Technology

The European Institute of Innovation and Technology (EIT) is an initiative that brings together actors to create Knowledge and Innovation Communities in support of technology research, development, demonstration and deployment across the European Union. The initiative was established by the European Parliament under Regulation No. 294 of 2008 with the ambition to connect businesses, entrepreneurs, researchers and other market actors through EIT's knowledge-sharing communities. Notably, these groups aim to support commercialisation and deployment of innovative technologies and encourage solutions by improving access to research findings, resources, networks and market opportunities.

EIT InnoEnergy<sup>5</sup> is one such community that prioritises clean energy solutions. This includes three specific industrial alliances targeting battery storage, green hydrogen and solar PV, where InnoEnergy aims to support innovations in these fields with the objective to provide industry with new technologies that decrease emissions and advance sustainability, whilst reducing energy costs, increasing system performance and improving industry competitiveness.

To achieve its ambition to catalyse and accelerate the clean energy transition, InnoEnergy provides support through a number of mechanisms, including finance through its InnoEnergy funds, loans and even venture capital. Bespoke support also includes assistance as needed for technical and business development and EIT provides equally opportunities for networking through events organised with industrial actors and investors.

By providing facilitated support and linkages between researchers, innovators and businesses, EIT has encouraged innovation in a number of clean energy sectors, including renewable energies, energy storage, sustainable cities and buildings, sustainable energy for transport and mobility, smart grids, and energy efficiency. To date, InnoEnergy has provided around EUR 560 million to more than 480 innovative solutions, helping clean energy developers to raise more than EUR 2.5 billion in total financing. These solutions are expected to generate about EUR 16 billion in commercial revenues by 2026 and, by 2030, companies supported by EIT are slated to save more than one billion tonnes of CO<sub>2</sub>-equivalent, whilst saving industry around EUR 9 billion in energy costs.

Source: (InnoEnergy, 2020<sup>[22]</sup>) (InnoEnergy, 2021<sup>[23]</sup>)



## Improved access to finance will increase capacity for bioenergy development

Colombia has taken a number of measures in recent years to address the role of finance in achieving its sustainable development goals and clean energy ambitions. This includes measures implemented by the Colombian Banking Association, Asobancaria, to promote better management, monitoring and reporting of environmental and social risks (IFC, 2018<sup>[24]</sup>). For instance, Asobancaria developed a voluntary Green Protocol (Protocolo Verde<sup>6</sup>) in 2012, which 13 banking institutions have since adopted (UNEP, 2021<sup>[25]</sup>). Asobancaria also issued detailed guidance on applying the Protocol in its 2016 General Guidelines for the Implementation of Environmental and Social Risk (Guía General de Implementación y Administración de Riesgos Ambientales y Sociales<sup>7</sup>).

Other initiatives, such as the government's National System for Climate Change (Sistema Nacional de Cambio Climático, SISCLIMA),<sup>8</sup> have improved ministerial co-ordination and public-private dialogue on climate finance to support project pipeline development. In 2018, SISCLIMA released a roadmap<sup>9</sup> for the development of green financial products (green bonds). This roadmap put forward actions to set the market foundations and to promote strategies for a strong green bonds market, building upon early issuances by the banks Bancolombia (2016), Davivienda and Bancóldex (2017) (IFC, 2018<sup>[24]</sup>). In addition, the Superintendence of Finance (Superintendencia Financiera) is currently developing a green taxonomy to support financial actors and stakeholders across the public and private sectors. The taxonomy will incorporate a set of clear definitions to support the identification and evaluation of investments that can be considered as green or environmentally sustainable. A first series of documents under Phase 1 of the taxonomy development were released for public consultation<sup>10</sup> in September 2021.

These actions, amongst others, will be important to ensure there is a solid framework to enable green finance flows in support of Colombia's NDC and the government's wider environmental and sustainable development ambitions. Still, achieving these goals and targets set forth in policies such as the Green Growth and Bioeconomy strategies will require scaling up overall finance and investment in clean energy solutions, including measures to address the cost of debt for project development.

### ***Tackling the cost of finance will support a stronger pipeline of bioenergy projects***

Currently, the cost of finance for bioenergy and other clean energy technologies can often be high, thereby limiting the pipeline of these projects. Part of this is due to limited experience with certain technologies, unfamiliarity with those types of projects and overall perceptions of risk by financial actors. Finance for some projects, including notably smaller transaction sizes (e.g. for rooftop PV and small biodigesters) can also be a challenge given the creditworthiness or lack of credit history of smaller borrowers. Difficulties in demonstrating clear revenue streams because of challenges in accessing long-term bilateral PPAs also play a hand in the cost of finance.

At the same time, the cost of finance is also influenced by the country's finance sector, which is controlled by a handful of financial groups with low competition. This contributes to high interest rate margins (calculated as the difference between deposit and loan rates) that can exceed 7%, which is well above the margins observed in other Latin American countries like Chile and Mexico (OECD, 2019<sup>[26]</sup>). These high interest rate margins create subsequent challenges not only for generation projects but also for industries looking to invest in clean energy technologies (e.g. for on-site bioenergy capacity).

Strengthening financial regulation and encouraging greater competition in the banking sector can help to address the overall cost of finance in Colombia. A number of second tier banks in Colombia such as Bancoldex, Findeter and Finagro already offer concessional credit lines for bioenergy project development. This is equally the case for commercial banks such as Bancolombia, which provides a line for renewable energy investments for its agricultural and agro-industrial customers, with concessional finance under a leasing model (Box 4.3).

### Box 4.3. Arroz Federal rice husk gasification plant financed under a leasing model

Arroz Federal, a rice producer located in Tolima in the centre-west of Colombia, invested in new bioenergy capacity in 2018 using rice husks as feedstock for power generation. The project, financed by Bancolombia, uses the husk by-product from the company's rice production, which otherwise is disposed of as waste. Biogas is produced from the husks, which in turn is used to generate electricity through an internal combustion engine coupled to a generator.

The project, which became operational in 2019, is the first industrial-sized power generation plant using rice husks in Colombia. The new generation capacity is expected to produce around 2.2 gigawatt-hours of electricity output, resulting in a yearly reduction of about 450 tonnes of CO<sub>2</sub> emissions. Additionally, the project will increase the mill's economic competitiveness by using available waste as direct feedstock for its energy needs. As Arroz Federal is grid connected, it could also potentially sell excess electricity to the grid, even if this is not currently envisaged for the project.

The facility investment was financed under a ten-year leasing model by Bancolombia for USD 772 million. Azimut Energía S.A.S., a company specialised in energy efficiency, implemented the project and is in charge of operating the system and guaranteeing that the energy production will meet Arroz Federal's annual consumption needs.

Bancolombia provided finance through its Leasing Agroverde line, which specialises in the modernisation of assets in the agricultural and agro-industrial sectors with objectives to improve productivity and environmental sustainability. While this type of project remains less common, the line of credit nevertheless provides attractive lending terms for energy efficiency and renewable energy projects as well as for sustainable construction and cleaner industrial production. It also provides technical advice on potential investments as needed and could be applied to similar bioenergy capacity installations.

Source: (Grupo Bancolombia, 2018<sup>[27]</sup>) (Grupo Bancolombia, 2021<sup>[28]</sup>)

Still, many potential borrowers remain cautious of such investments, given the uncertainty and unfamiliarity with bioenergy technologies and their business models. Awareness raising and capacity building, such as the technical assistance offered by Bancolombia under its sustainable credit line to help borrowers to identify the appropriate technologies and relevant equipment suppliers should therefore be considered as a part of efforts to address access to finance and the overall cost of capital. Other support such as use of green credit facilities and targeted concessional lending can also encourage financing for bioenergy projects, particularly where borrowers or technologies are perceived as risky by private capital. For example, microfinance arrangements with local financial institutions can facilitate access to capital for small businesses or farmers looking to develop small on-site bioenergy solutions (Box 4.4).

#### Box 4.4. Microfinance to improve access to clean energy finance in Bangladesh

The World Bank's Rural Electrification and Renewable Energy Development (RERED) programme used a combination of concessional credit and subsidies in Bangladesh to help develop a market for affordable clean energy solutions such as solar home systems, clean cookstoves and small bioenergy projects. Launched in 2008, the programme supported the installation of over one thousand solar irrigation pumps, 10 thousand domestic biogas digesters, 1.9 million improved cookstoves and 3.1 million solar home systems.

Finance for the RERED programme originated with the World Bank's International Development Association, which provided concessional credit with long-term maturity (38 years) to Bangladesh's Ministry of Finance. The World Bank equally acted as a conduit for grants from other parties, such as the Global Environment Facility, the Global Partnership on Output Based Aid and the Asian Development Bank. The Ministry of Finance then channelled these funds and concessional credit to Infrastructure Development Company Limited (IDCOL), a government-owned non-bank financial institution that implemented the programme. This included support through capacity building with local financial actors, such as microfinance institutions and technology providers, to increase capacity and improve familiarity with clean energy solutions. Local financial actors then helped to create demand for projects amongst their clients using tailored microfinance, such as purchase contracts and microcredit agreements.

A key part of the RERED programme was technical assistance to enable technology promotion and market development activities, alongside overall capacity for programme administration, monitoring and evaluation. Specifically, IDCOL provided training and capacity building to help partner organisations to develop technical expertise beyond their normal financial activities, which allowed them to become clean energy technology dealers (e.g. with technicians installing the technologies). A multi-layered monitoring and quality control process also helped to address issues in early stages of the programme.

Importantly, the RERED programme helped to overcome barriers such as access to affordable finance and low technical capacity in low-income markets. The targeted use of grants and concessional credit not only supported market development and de-risking activities but it also encouraged local financial institutions to take on projects previously considered as "non-productive loans". Economies of scale through the partnerships equally helped to bring down the cost of technology solutions in local markets, thereby improving the business case for lending. The overall success of the initiative was underscored by the entry of a number of private competitors outside the initiative, enabling market replication and attractive financing without support of the RERED programme.

Source: (World Bank, 2020<sup>[29]</sup>); (World Bank, 2014<sup>[30]</sup>)

#### **Public funds and blended finance can de-risk projects and leverage private capital**

Support can also be designed within or around existing funds and financial instruments. For instance, financing for local and municipal infrastructure projects under Territorial Development Finance (Financiera De Desarrollo Territorial, Findeter) could be used to support municipal waste-to-energy projects. Dedicated mechanisms (e.g. for biogas developments with industry) could similarly be designed within funds under the national development bank (Financiera de Desarrollo Nacional) or with the Ministry of Finance and Public Credit. Tools could likewise be designed in collaboration with banks such as Bancoldex or

Bancolombia, which already apply preferential interest rates under a leasing model for some clean energy projects, or with international development support.

While Colombia already has a number of national funds that are designed to support development of clean energy projects, these mostly provided support through grants. This limits the number of projects that can be supported and does not encourage active participation of private capital. Applying these funds more strategically (e.g. as tools for risk mitigation) will help to mobilise greater private investment and financing at improved rates. For example, FENOGE has a permanent source of capital through charges on electricity and has used this to support projects through grant-based schemes (GGGI, 2019<sup>[31]</sup>). Yet, the fund cannot currently lend to projects or invest in equity, which limits the scale of its activities. Widening the mandate to broaden FENOGE's activities for co-investment in clean energy projects with private sector engagement would help the fund to play a larger role in scaling up finance and investment in clean energy solutions, for instance by targeting the injection of public support to diminish perceived risk for technologies like anaerobic digestion technologies.

The national fund for the electrification of ZNI (Fondo de apoyo financiero para la energización de las zonas no interconectadas) and the financial support fund for inter-connected rural zones (Fondo de Apoyo Financiero para la Energización de las Zonas Rurales Interconectadas) similarly could be tailored to support the financing of bioenergy projects in ZNI and rural areas. De-risking tools such as guarantees and credit enhancement can help enable less-established renewable energy technologies and businesses to access private finance (OECD, 2021<sup>[32]</sup>). On-lending and co-lending structures can likewise increase the availability of attractive finance whilst helping local finance institutions to gain confidence in lending to renewable energy projects (IRENA, 2016<sup>[33]</sup>). For instance, the Clean Energy Finance Corporation of Australia uses aggregation partnerships with commercial banks throughout the country to offer debt (on-lending) for financing of eligible clean energy technologies.<sup>11</sup> This wholesale finance model offers low-cost funding to financial partners, who in turn can offer attractive terms such as discounted interest rates. As of 2019, these partnerships enabled over AUD 800 million (about USD 575 million) in investments in more than 5 500 small-scale projects (Wapner and Youngs, 2019<sup>[34]</sup>).

Colombia can also work with multilateral and international funds to design blended finance mechanisms that help to catalyse private finance for bioenergy projects. For example, the United Kingdom's Partnering for Accelerated Climate Transitions (UK PACT) Green Recovery Challenge Fund and the World Bank's Scale-up Climate Finance initiative both have targeted bioenergy as part of their support for clean energy development. A number of these global funds<sup>12</sup> could be leveraged to draw in private finance for bioenergy projects in Colombia through de-risking instruments like first loss and partial risk guarantees, co-investments and subordination, amongst others.<sup>13</sup> Blended finance mechanisms under the Ministry of Finance and Public Credit could be used to channel climate finance and development funds to bioenergy projects, possibly through the creation of a multi-donor blended finance platform such as the Indonesia One Fund (Box 4.5). Experiences with other dedicated green finance facilities such as those in Mongolia and South Africa equally highlight the role of different models that can be used to enable private investments in clean energy and crowd in private capital for projects that would not otherwise be financed by the market (OECD, 2021<sup>[8]</sup>).

#### Box 4.5. Achieving Sustainable Development Goals (SDG) through the SDG Indonesia One Fund

Indonesia has been an active contributor to the development of blended finance mechanisms that use development funds to help catalyse private finance. In 2018, the country's Ministry of Finance and the state-owned enterprise responsible for financing infrastructure projects in the country (PT Sarana Multi Infrastruktur, PT SMI) launched an integrated blended finance platform known as SDG Indonesia One. The initiative is a multi-donor blended finance platform with about USD 3 billion in funding commitments for supporting Indonesia's achievement of its SDGs. It is one of the first such initiatives globally, integrating multiple funding areas across the stages of project development, from project preparation and de-risking to financing and equity.

At the implementation level, PT SMI is responsible for managing the fund and working closely with development finance institutions in setting up a variety of financing facilities, including those dedicated to supporting clean energy development. These flexible financing products can include first loss instruments and partial risk guarantees, as well as co-investments and subordination. One notable example is the use of a grant from the French development bank Agence Française de Développement to set up a first-loss mechanism covering a maximum of 15% of the loan value for a mini-hydro plant. This helped to encourage other commercial banks to fund the project.

In effect, the SDG One Indonesia fund is designed to leverage donor funds to improve project bankability and crowd in private capital. For example, the platform's equity fund can be used to create opportunities for private capital to participate in greenfield and brownfield projects. This strategic use of blended finance will help to enable clean energy solutions in Indonesia, improving market viability and demonstrating the business opportunities and financing models for clean energy technologies.

Sources: (ADB, 2020<sup>[35]</sup>) and (PTSMI, 2021<sup>[36]</sup>).

#### ***Capital markets are an untapped opportunity for clean energy development***

Meeting the overall investment needs for Colombia's renewable energy ambitions, including bioenergy development, will also require increased availability of long-term capital, alongside further development of the country's capital market. The stock and bond markets in Colombia are both less developed than those in some regional peers, thereby missing the opportunity to shift savings from short-term deposits towards longer-term investments like clean energy development (OECD, 2019<sup>[17]</sup>). Recent green bond issuances, including Colombia's first sovereign green bond in September 2021 as well as green and sustainable bond issuances by Banco W and Icetex that were supported by Bancolombia, are encouraging signals of progress in engaging the financial sector and capital market to meet the country's sustainable development ambitions. Still, obstacles impede important opportunities to attract long-term finance for clean energy assets and investments.

In particular, the corporate bond market in Colombia remains underdeveloped compared to regional peers, namely due to low liquidity and financial sector issues, including higher costs of bond issuances than bank credits, few institutional investors and a highly regulated investment environment (OECD, 2019<sup>[17]</sup>). The result is that most bond issuance has been by the government and financial sector issuers (e.g. for green financial products) with little corporate green bond issuance (UNEPFI, 2020<sup>[37]</sup>). In fact, while Colombia was the second largest Latin American issuer of sovereign bonds in international debt markets for the first quarter of 2021, it was the second smallest issuer of international corporate bonds (UNECLAC, 2021<sup>[38]</sup>).

The capital market has likewise not been a significant source of funding for clean energy projects. There are only a few large companies comfortable with the costs and benefits of listing on the securities market, which is not uncommon in Latin America (OECD, 2019<sup>[26]</sup>). However, the Colombian equity market has noticeably lower liquidity levels compared to its peers, and in 2017, the average annual trading volume of the market represented only 4.2% of GDP (by comparison, Chile and México were 13.7% and 9.5%, respectively). Moreover, market capitalisation of domestic companies (39% of GDP in 2020, (World Bank, 2021<sup>[39]</sup>)) also has moved towards consolidation and delisting among public companies: from 110 stock issuers in 2001 to 68 in 2019 (Reuters, 2019<sup>[40]</sup>). This is notably due to burdensome regulation, including listing and disclosure requirements, which drive up the cost of listing companies. This can be particularly dissuasive for small and medium enterprises (OECD, 2019<sup>[17]</sup>).

In response, the government created a Capital Market Mission (Misión Mercado de Capitales)<sup>14</sup> in late 2018, which subsequently identified critical barriers that have not allowed market development and provided a number of recommendations for future action in its final report in 2019. These suggested measures and reforms should support achievement of a deeper, more efficient capital market that can support more robust financing for clean energy projects and companies (e.g. by reducing the costs of access to the market). Additional measures, such as the emerging taxonomy framework, will also help to support capital flows towards green projects and clean energy development.

Building on these promising developments, the government can consider further policy and regulatory actions to help diversify financial products and develop capital market instruments for clean energy projects. These can be complemented by measures such as training and capacity building to familiarise market actors with the institutional and operational aspects of those projects. Standardisation of project documentation and measures to address issues of scale necessary to attract international capital (e.g. through support for aggregation and securitisation of projects) can develop use of debt market instruments, such as asset backed securities and sustainability-linked bonds. These instruments will help to deepen and expand the current investor base for clean energy development, for instance by tapping into international institutional investors such as insurance and pension funds.

Tapping into capital markets can also help to recycle capital for clean energy development, including possible refinancing at more attractive terms. Globally, institutional capital has shown a preference for operating assets (e.g. existing bioenergy cogeneration and hydropower capacity), as these typically have clear revenue streams and avoid investor risks in the design and development stages of a project. In fact, between 2009 and 2019, over 75% of global renewable energy deals involving institutional investors were in operating assets (IRENA, 2020<sup>[41]</sup>). Support for the early design and use of capital market instruments (e.g. possible application of a credit enhancement mechanism to help clean energy projects to achieve credit ratings of AA and above) can help to unlock access to these institutional markets, whilst generating interest in further developments by providing a clearer risk-return profile for investors.

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## Notes

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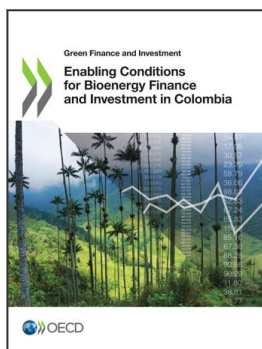
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<sup>13</sup> For more information, see: [OECD Progress update on Approaches to Mobilising Institutional investment for Sustainable Infrastructure](#).

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