

FINANCING GUIDELINES FOR THE TECHNOLOGIES AND TECHNOLOGY ACTION PLANS IN THE TNA_BRAZIL PROJECT



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List of Abbreviations and Acronyms

AND –	Autoridade Nacional Designada
BNDES –	Banco Nacional do Desenvolvimento (National Development Bank)
CTCN –	Climate Technology Centre and Network
DFI –	Development financial institutions
DNA –	Designated National Authority
FI –	Private financial institution
Finep –	Financiadora de Estudos e Projetos (Financier of Studies and Projects)
GCF –	Green Climate Fund
GEF –	Global Environment Facility
GHG –	Greenhouse gases
ME –	Ministério da Economia (Ministry of Economy)
NDC –	Nationally Determined Contribution
PA –	Precision agriculture
PES –	Payment for Environmental Services
PNA –	Plano Nacional de Adaptação à Mudança do Clima (National Climate Change Adaptation Plan)
PNMC –	Política Nacional sobre Mudança do Clima (National Policy on Climate Change)
STI –	Science and Technology Institute
TEC –	Technology Executive Committee
UNFCCC –	United Nations Framework Convention on Climate Change

List of Figures

Figure 1 – Accessibility level of support modalities, by type of beneficiary	14
Figure 2 – Step-by-step procedure to use the electronic guide	33
Figure 3 – Financing options for precision agriculture TAP actions	47
Figure 4 – Financing options for industry 4.0 TAP actions	48
Figure 5 – Financing options for use of agricultural and agro-industrial waste TAP actions	49
Figure 6 – Financing options for floating solar TAP actions	50
Figure 7 – Financing options for photovoltaic solar induction stove TAP actions	51
Figure 8 – Financing options for flex hybrid vehicle TAP actions	52
Figure 9 – Financing options for mixed planting silviculture for restoration TAP actions	53
Figure 10 – Financing options for genetic improvement in beef cattle TAP actions	54
Figure 11 – Financing options for TAP actions for satellite monitoring, silviculture and genetic improvement of native species, innovative materials for cement and ethanol fuel cell electric vehicles	56

List of Tables

Table 1 – Methodology for classifying the mapped financing modalities and support mechanisms	15
Table 2 – General characteristics of the repayable loans modality	16
Table 3 – Example of a national repayable loan mechanism: BNDES ABC	17
Table 4 – Example of an international repayable loan mechanism: Green Climate Fund	18
Table 5 – General characteristics of the guarantee modality	19
Table 6 – Example of a guarantee mechanism: BNDES FGI	20
Table 7 – General characteristics of the non-repayable loan modality	21
Table 8 – Example of a national non-repayable loan mechanism: Finep 2030	22
Table 9 – Example of an international non-repayable loan mechanism: Global Environment Facility	23
Table 10 – General characteristics of the technical assistance modality	24
Table 11 – Example of an international technical assistance mechanism: CTCN	25
Table 12 – General characteristics of the equity modality	26
Table 13 – Example of an equity mechanism: IFC	27
Table 14 – General characteristics of the debt securities modality	28
Table 15 – Example of issuance of Klabin debt securities	29
Table 16 – General characteristics of the payment for environmental services (PES) modality	30
Table 17 – Example of a PES mechanism: REDD+ in Brazil	31
Table 18 – Practical example: use of the tool and accessibility classification	41
Table 19 – Internal barriers to the development of R&D projects by companies and credit from financial institutions	60

Symbols

STAKEHOLDERS



Federal



State



Municipality



Public company



Large company



Medium company



Micro and small company



Associations

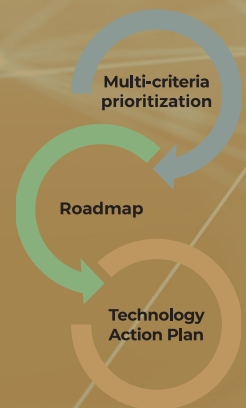


Cooperatives

Table of Contents

INTRODUCTION	11
1. FINANCING MODALITIES	13
1.1. Repayable loans	16
1.2. Guarantees	19
1.3. Non-repayable loans	21
1.4. Technical assistance	24
1.5. Equity	26
1.6. Debt Securities	28
1.7. Payment for Environmental Services	30
2. ELETRONIC GUIDE TO FINANCING OPTIONS FOR THE TECHNOLOGIES PRIORITIZED IN THE TNA_BRAZIL PROJECT	32
3. FINANCING MECHANISMS TO PROMOTE THE ADOPTION OF THE TECHNOLOGY ACTION PLANS	44
4. BARRIERS AND CONDITIONS TO ACCESS FINANCING	57
CONCLUSIONS	62
GLOSSARY OF TERMS	64
REFERENCES	67

Introduction



Introduction

The “Technology Needs Assessment for the Implementation of Climate Action Plans in Brazil (TNA_BRAZIL)” project aims to strengthen the technical capacity of the Brazilian government with the development of a comprehensive assessment of technology needs for the implementation of climate action plans in Brazil, and provide subsidies for decision making to support the GHG mitigation targets under Brazil’s Nationally Determined Contribution (NDC) and the country’s strategy for the Green Climate Fund (GCF) (BRASIL, 2021a).

For the elaboration of the Technology Action Plans (TAPs), the following technology packages were prioritized: floating photovoltaic solar energy; flex hybrid vehicles; ethanol fuel cell electric vehicles; use of agricultural and agro-industrial waste; photovoltaic solar induction stoves; innovative materials for cement; industry 4.0; precision agriculture (PA); genetic improvement in beef cattle; silviculture and genetic improvement of native species; mixed planting silviculture for restoration; and satellite monitoring (BRASIL, 2021b; 2021c).

This document aims to potentialize the implementation of the Plans, through subsidies to facilitate access to financing mechanisms for the prioritized technologies for governments, companies, associations and cooperatives, among others. In addition, it complements the “*Guia Eletrônico das Opções de Financiamento para as Tecnologias Priorizadas no Projeto TNA_BRAZIL – Eletronic guide*”, which identifies support mechanisms associated with the standardized financing modalities described in this document. The tool allows the user to filter the mechanisms according to the needs and profile of the beneficiary (BRASIL, 2021d). For each financing instrument, the tool identifies the type of beneficiary, sources of funds, eligible technologies and the step-by-step procedure to access financing, among other important data.

In this way, it aims to overcome obstacles to financing for projects that address climate change mitigation and adaptation, considering that “today, the biggest challenge faced by small and medium-sized industries is where and how to access credit lines for this purpose” (FIESP, 2017).

This document is divided into four sections, in addition to this introduction and final considerations:

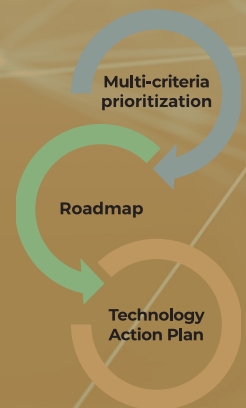
- “Financing modalities”: this section describes and ranks the financial support modalities, describes their main characteristics and presents example cases;
- “Eletronic guide to Financing Options for the Prioritized Technologies in the TNA_BRAZIL Project”: this section provides a step-by-step guide for using the *eletronic guide* (BRASIL, 2021d);
- “Mapped Financing mechanisms to support the adoption of Technology Action Plans”: this section presents a general framework linking the financial support modalities to the TAP actions, as well as providing a list of the financing mechanisms currently available by applicable modality;
- “Barriers and conditions to access financing”: this section describes the barriers and conditions to access financing for climate technology projects in the available credit modalities and how to mitigate them.

We recommend you read the sections “Symbols” (before this introduction) and “Glossary” (at the end of the document) to ensure you get the best results when using this guide.

This document is intended for governments, companies, cooperatives and associations that intend to implement the TAPs in the TNA_BRAZIL project.

1.

Financing **Modalities**



1. FINANCING MODALITIES

The support modalities presented below are quite diverse, ranging from traditional commercial bank financing to more complex alternatives, such as debt securities. They are accessible, in varying degrees, to specific beneficiaries and projects, so it is important to understand the concepts, barriers and advantages of each one.

(Federal, state and municipal), cooperatives or associations to facilitate the implementation of the technologies prioritized in the TNA_BRAZIL project. For example, large companies can finance their projects by issuing debt securities; however, some guarantee options are only for small businesses.

With a general understanding of the modalities, you can identify which types can be accessed by companies (public, large, medium, small and micro), governments

To illustrate these differences, Figure 1 shows the support modalities according to their level of accessibility and type of eligible beneficiary.

SUPPORT MODALITIES RANKED ACCORDING TO ACCESSIBILITY	TYPE OF ELIGIBLE BENEFICIARY ¹		
	GOVERNMENT	COMPANIES	ASSOCIATIONS AND COOPERATIVES
Repayable loans			
Guarantee			
Non-repayable loans			
Technical assistance			
Equity		Small, medium and large	
Debt securities	Federal	Medium and large	
Payment for Environmental Services (PES)			

Note 1: The type of eligible beneficiary may vary depending on the financing mechanism. For more information, access the “*Guia Eletrônico das Opções de Financiamento para as Tecnologias Priorizadas no Projeto TNA_BRAZIL*” (BRASIL, 2021d).

LEGEND

Level of accessibility	Eligible beneficiary
Ample	Accessible
Moderate	Not accessible
Limited	

Figure 1 – Accessibility level of support modalities, by type of beneficiary

Source: the author.

This is a general classification, taking into account the average of the mapped support mechanisms. Due to variations in the internal procedures of support mechanisms, the *Eletronic guide* (BRASIL, 2021d) presents an accessibility rating for each mechanism. Thus, among the mapped mechanisms, some may be classified as more or less strict than the average cited here.

It should be emphasized that standardized modalities are those that are accessed with following a set of procedures and steps defined by the support institution.

On the other hand, non-standardized modalities are those where access occurs on a case-by-case basis, beneficiary to beneficiary, and thus cannot be presented in the tool.

To understand the rationale behind the ranking and rating of the tool, see the table below.

Following the methodology, the modalities are characterized and examples of credit mechanisms are presented by type.

Table 1 – Methodology for classifying the mapped financing modalities and support mechanisms

METHODOLOGY FOR CLASSIFYING MODALITIES AND MECHANISMS
<p>The methodology to rank support modalities and classify their mapped mechanisms seeks to identify which modalities and mechanisms are more accessible, or more limited. The classification of each support mechanism is presented in the <i>Eletronic guide</i> (BRASIL, 2021d). The ranking is defined using the average rating of each modality.</p> <p>The methodology has three steps:</p> <p>A. BENEFICIARY PROFILE: modalities and mechanisms aimed at satisfying a greater number of beneficiary profiles tend to be more accessible. We assessed how many of the nine beneficiaries can apply for these modalities, namely:</p> <ul style="list-style-type: none"> • Government beneficiaries: Federal, state and municipal (three beneficiaries); • Types of companies: public companies, micro and small companies, medium and large companies (four beneficiaries); • Associations and cooperatives (two beneficiaries). <p>Metric:</p> <ul style="list-style-type: none"> • 3 points – six to nine types of beneficiaries; • 2 points – three to five types of beneficiaries; • 1 point – one or two types of beneficiaries. <p>B. TECHNOLOGIES: modalities/mechanisms targeting a greater number of prioritized technologies are more accessible.</p> <p>Metric:</p> <ul style="list-style-type: none"> • 3 points – at least nine technologies; • 2 points – five to eight technologies; • 1 point – less than five technologies. <p>C. SUPPORT REQUEST REQUIREMENTS: need to meet rigorous requirements for access to support mechanisms, such as credit ratings and special accreditation in international institutions, among others.</p> <p>Metric:</p> <ul style="list-style-type: none"> • 3 points – basic requirements and low cost; • 2 points – requirements that require effort and/or moderate costs; • 1 point – requirements that require effort and high costs. <p>After the consolidation of the metric results for each modality and support mechanism, the corresponding accessibility classification was determined:</p> <ul style="list-style-type: none"> • 8 to 9 points – ample accessibility; • 3 to 7 points – moderate accessibility; • 3 to 4 points – limited accessibility.

Source: the author.

1.1. Repayable loans



Repayable loans are available to all types of beneficiaries, regardless of their nature or size. The amount received must be repaid, with interest (and any financial institution charges or fees) and in installments, as determined in the contract.


This modality includes green or sustainable credit mechanisms. These mechanisms are aimed at financing initiatives that promote positive environmental impacts, such as the technology packages prioritized in the Action Plans of the TNA_BRAZIL project.

Table 2 – General characteristics of the repayable loans modality

REPAYABLE LOANS	
STANDARDIZED MODALITY	
Level of accessibility	Ample
Type of support institution	<ul style="list-style-type: none"> • Private financial institutions (FI); • Development financial institutions (DFI).
Type of beneficiary	<ul style="list-style-type: none"> • Government: Federal, state and municipal; • Companies: public, large, medium, small and micro; • Associations; • Cooperatives.
Main barriers	<ul style="list-style-type: none"> • Credit analysis: the support institution seeks to ensure that the beneficiary will be able to make the payments and, depending on the credit profile of the beneficiary, this determines the amount of capital made available, as well as the interest rate charged and the maximum number of payment installments; • Guarantees: it is common to require collateral (real estate, shares, financial investments) or personal guarantees (promissory or surety); • Requirement to present a detailed budget demonstrating that the resources will be invested in accordance with green mechanism guidelines.
Main advantages	<ul style="list-style-type: none"> • Little bureaucracy and quick availability of resources; • Possibility of subsidized interest rates; extended grace period; and/or longer payment terms for green mechanisms.


Source: the author.

Table 3 – Example of a national repayable loan mechanism: BNDES ABC

BNDES ABC
 <p>The objective is to finance investments that contribute to the reduction of environmental impacts in agricultural activities. Directed to private, micro and small companies in any state in Brazil.</p> <p>APPLICATION OF RESOURCES:</p> <p>The mechanism can be used to finance the following technologies prioritized in the Action Plans of the TNA_BRAZIL project: PA; genetic improvement in beef cattle; use of agricultural and agro-industrial waste; satellite monitoring; mixed planting silviculture for restoration; and silviculture and genetic improvement of native species.</p> <p>With terms of up to 120 months, it offers fixed interest rates of up to 6% per year (p.a.) or a post-fixed rate of 2.5% p.a. + monetary adjustment factor. It is possible to access between BRL 150,000 and BRL 5 million for individual loans, or BRL 20 million for collective undertakings, with guarantees determined on a case-by-case basis.</p> <p>STEPS:</p> <p>Indirect support: an accredited financial institution of your choice will inform you of the necessary documentation, analyze the possibility of granting credit and negotiate the guarantees. Once approved, the operation is forwarded to the National Development Bank (BNDES) protocol department for approval and subsequent payment of funds.</p> <p>Direct support: for amounts above BRL 10 million, send your request for financing directly to BNDES, through the “Electronic Prior Consultation” system.</p>

Source: the author.

Table 4 – Example of an international repayable loan mechanism: Green Climate Fund

GREEN CLIMATE FUND (GCF)
 <p>It funds projects and programs aligned with national policies and/or plans to reduce GHG emissions, increase resilience to climate change and achieve social, economic and environmental development goals, including the Nationally Determined Contribution (NDC), the National Policy Plan on Climate Change (PNMC) and the National Plan for Adaptation to Climate Change (PNA), among others.</p> <p>The GCF has been working with the Technology Executive Committee (TEC) and the Climate Technology Centre & Network (CTCN), under the United Nations Framework Convention on Climate Change (UNFCCC), to catalyze the innovation process in incubators and accelerators for climate technologies in developing countries. In this context, the three main actions are: i) support for strengthening the business ecosystem in developing countries; ii) research on ways to attract private funding for early stages of climate technology development; and iii) support for the development of new incubation models. In Brazil, there are projects in the early stages of development (incubators) with accredited entities that are expected to be evaluated by the GCF Council in 2021.</p> <p>APPLICATION OF RESOURCES</p> <p>The resources can be accessed by the public and private sectors in GCF strategic impact areas:</p> <ul style="list-style-type: none"> • Generation and access to energy; • Transport; • Forests and land use; • Buildings, cities, industry, facilities and equipment; • Water, food and health security; • Livelihood of people and communities; • Ecosystems and ecosystem services; • Infrastructure and built environment. <p>STEPS:</p> <ol style="list-style-type: none"> 1. Preparation of a project concept note with the executing entity (bank executing the financing) and the accredited entity (bank approved by the GCF) and its approval by the Secretariat for International Economic Affairs of the Ministry of Economy (ME), which is Brazil's Designated National Authority (DNA) for the GCF; 2. Elaboration of a complete financing proposal to be sent to the GCF; 3. Request for no objection from the DNA; 4. Submission of the complete financing proposal and no objection term to the GCF Board of Directors; 5. GCF Board of Directors analysis, recommendation and decision; 6. Legal arrangements with the GCF and letter of commitment. <p>Information on accredited entities and executing entities in Brazil can be found in GCF (2021a; 2021b).</p>

Source: the author.



For more details on these and other support mechanisms in this modality, access the *Eletronic guide* (BRASIL, 2021d).

1.2. Guarantees



Guarantees are formal commitments in which the guarantor assumes obligations to the financier in the event of non-payment or non-fulfillment of the beneficiary's responsibilities. It is in the interest of governments that their development finance institutions provide these guarantees to encourage commercial banks to grant loans.

Thus, this modality is used to complement the beneficiary's guarantees, or to serve as a total guarantee in order to obtain credit, in addition to ensuring better financing conditions (terms, grace period etc.) due to the reduction of risks in the operation. The contracting of the guarantee, however, has a cost.


This mechanism is normally used in transactions where the beneficiary has a higher credit risk, which may occur due to different credit market conditions.

Table 5 – General characteristics of the guarantee modality

GUARANTEE	
STANDARDIZED MODALITY	
Level of accessibility	Ample
Type of support institution	<ul style="list-style-type: none"> • Development financial institutions (DFI).
Type of beneficiary	<ul style="list-style-type: none"> • State: Federal, state and municipal; • Companies: public, large, medium, small and micro; • Associations; • Cooperatives.
Main barriers	<ul style="list-style-type: none"> • Limit of guarantees available and offered by DFIs; • Cost of contracting the guarantee may make the investment unfeasible.
Main advantages	<ul style="list-style-type: none"> • Increased access to credit; • Better credit limits and terms.

Source: the author.

Table 6 – Example of a guarantee mechanism: BNDES FGI

BNDES FGI
 <p>BNDES FGI aims to facilitate credit for micro, small and medium companies, as well as individual entrepreneurs, to support growth and modernization.</p> <p>Companies with difficulties to provide the guarantees required by financial institutions are often unable to contract financing. The BNDES FGI complements the guarantees offered by companies, facilitating approval and providing more favorable terms (grace period, terms and payments).</p> <p>BNDES FGI is an alternative to support the needs of companies for working capital, acquisition of national machinery and equipment and projects to expand production units.</p> <p>Only micro, small and medium companies with annual gross operating revenues of up to BRL 300 million are eligible.</p> <p>APPLICATION OF RESOURCES</p> <p>BNDES FGI guarantees can be used for projects in any sector. Thus, all the technology packages prioritized in the TNA_BRAZIL project can use this guarantee fund for their implementation.</p> <p>STEPS</p> <p>To obtain financing with BNDES FGI guarantees, the company or entrepreneur should request access through a qualified commercial bank. The list of banks is available in the TNA_BRAZIL project <i>Eletronic guide</i> (BRASIL, 2021d).</p>

Source: the author.



For more details on these and other support mechanisms in this modality, access the *Eletronic guide* (BRASIL, 2021d).

1.3. Non-repayable loans



Non-repayable loans are resources made available to beneficiaries without the requirement to repay the amount to the supporting institution, as long as the project’s purposes are fulfilled.

To maximize the impact of this modality, it is common for them to be made available in conjunction with other incentive modalities, such as soft lending repayable loans with more favorable terms than practiced in the market.


Development financial institutions operate in this modality by directing resources through public calls to promote research, development and technological innovation. These loans assess the degree and importance of innovation, the potential to develop national technology, as well as the risks. Thus, projects for the development of technologies to reach a degree of commercial maturity can benefit from this modality.

Table 7 – General characteristics of the non-repayable loan modality

NON-REPAYABLE LOANS	
STANDARDIZED MODALITY	
Level of accessibility	Moderate
Type of support institution	<ul style="list-style-type: none"> Development financial institutions (DFIs), public companies and philanthropic funds.
Type of beneficiary	<ul style="list-style-type: none"> State: Federal, state and municipal; Companies: public, large, medium, small and micro; Associations; Cooperatives.
Main barriers	<ul style="list-style-type: none"> High degree of bureaucracy for submitting proposals in public tenders (Brazil); Strong competition for access to capital (internal and external).
Main advantages	<ul style="list-style-type: none"> No capital costs; Makes investments in high-risk projects with long-term results more feasible.

Source: the author.

Table 8 – Example of a national non-repayable loan mechanism: Finep 2030

FINEP 2030 (ROTA 2030 – MOBILITY AND LOGISTICS)
 <p>Finep 2030 is a priority program in the federal government’s Rota 2030 – Mobility and Logistics program. Among its objectives is the development of the automotive sector chain with non-repayable financial support for innovation projects.</p> <p>The mechanism provides BRL 200 million in financing from the Rota 2030 program (operated by the Financier of Studies and Projects – Finep), and BRL 70 million from Finep resources over a period of five years.</p> <p>APPLICATION OF RESOURCES</p> <p>Resources can be accessed by Science and Technology Institutes (STIs) and companies. The support is available to the entire automotive innovation and mobility chain, from basic and applied research to the technological development of prototypes and final introduction of products on the market.</p> <p>The innovation areas supported by the program are compatible with the technologies prioritized in the TNA_BRAZIL project, including:</p> <ul style="list-style-type: none">• Hybrid and electric motorization: Action Plan for ethanol fuel cell electric vehicles and flex hybrid vehicles;• 1st and 2nd generation biofuels: Action Plan for the use of agricultural and agro-industrial waste;• Efficiency of mobility and logistics industries: Action Plan for industry 4.0. <p>STEPS</p> <p>Interested parties should observe the terms of the public notice to verify their eligibility. After registration and submission of the application proposal (electronically), the investment analysis is carried out in three selection stages:</p> <ul style="list-style-type: none">• Business plan evaluation;• In-person evaluation board;• Technical visit and assessment of legal documentation. <p>In each selection, up to 25 companies are selected for financing.</p>

Source: the author.

Table 9 – Example of an international non-repayable loan mechanism: Global Environment Facility

GEF – POZNAN STRATEGIC PROGRAM ON TECHNOLOGY TRANSFER
 <p>This Global Environment Facility (GEF) program is designed to promote the transfer of environmentally clean technologies to help developing countries make the transition to a low-carbon economy.</p> <p>Discussed and approved by the GEF and Least Developed Country Fund (LDCF) boards and the Special Climate Change Fund (SCCF), the program was implemented in 2008 at the COP14.</p> <p>The program supports technology transfer through the following actions:</p> <ol style="list-style-type: none">1. Support in the process of identifying technologies for mitigating and adapting to climate change (Technology Needs Assessment Report – TNA);2. Financing of pilot projects to carry out the implementation, diffusion and transfer of technologies;3. Dissemination of GEF experience in successful technologies;4. Long-term implementation: support for priority climate technology centers and networks, promoting innovation and investment, public-private partnerships, catalyzing technology transfer. <p>APPLICATION OF RESOURCES</p> <p>The program supports countries in the implantation, diffusion and transfer of technologies considered priority in the TNA report.</p> <p>STEPS</p> <ol style="list-style-type: none">1. Develop the basic concept and structure of the project;2. Submit project for analysis by the Operational Focal Point in the country (in the case of Brazil, the General Coordination of External Financing of the Secretariat for International Economic Affairs of the Ministry of Economy);3. Obtain a letter of formal endorsement on consistency and alignment with GEF eligibility criteria and country priorities;4. Establish a partnership with one of the GEF Partner Agencies in Brazil, indicated by the Operational Focal Point;5. Develop a complete proposal with the Agency, including technical details of the project to be implemented;6. Final submission of the project to the GEF for evaluation.

Source: the author.



For more details on these and other support mechanisms in this modality, access the *Eletronic guide* (BRASIL, 2021d).

1.4. Technical assistance



Technical assistance is a modality where financial resources are not granted to beneficiaries, but rather only advisory services. However, these institutions work in a coordinated manner (and in collaboration) with banks and credit unions, and are aligned with national and subnational government entities.

The support involves modern techniques that can be applied in all sectors of the economy. The human

resources provided assist in the elaboration, planning, execution, coordination and monitoring of projects, improving the efficiency, competitiveness and sustainability of beneficiary organizations.

Thus, these services promote the diffusion and transfer of technical knowledge to ensure the feasibility and execution of projects that promote positive economic, social and environmental benefits.

Table 10 – General characteristics of the technical assistance modality

TECHNICAL ASSISTANCE	
STANDARDIZED MODALITY	
Level of accessibility	Moderate
Type of support institution	<ul style="list-style-type: none"> Development Financial Institutions (national and international), public companies and non-profit entities.
Type of beneficiary	<ul style="list-style-type: none"> Government: Federal, state, municipal; Companies: Public, large, medium, small and micro; Associations; Cooperatives.
Main barriers	<ul style="list-style-type: none"> High competition for resources; Inability to use resources for capital expenses (Capex) for projects.
Main advantages	<ul style="list-style-type: none"> Free of charge or subsidized access to high-cost services with highly qualified human resources.

Source: the author.

Table 11 – Example of an international technical assistance mechanism: CTCN

CLIMATE TECHNOLOGY CENTRE AND NETWORK (CTCN)
 <p>It provides technical assistance to developing countries, mobilizing its global network of experts to identify and develop technological climate solutions suited to local needs. The CTCN also trains and advises countries on their public policies and legal and regulatory frameworks for the transition to a low-carbon economy.</p> <p>The CTCN offers funding of USD 50,000 and USD 250,000.</p> <p>APPLICATION OF RESOURCES</p> <p>Five types of technical assistance are available:</p> <ol style="list-style-type: none">1. Technology Needs Assessment reports;2. Technical support for the development of strategies, policies and action plans;3. Training;4. Tools and methodologies;5. Implementation plans. <p>All technologies prioritized in the TNA_BRAZIL project are eligible for support from the CTCN at some implementation stage.</p> <p>STEPS</p> <p>Requests for technical assistance must be made through the CTCN Designated National Entity for Brazil, which is the General Coordination of Climate Science and Sustainability of the Ministry of Science, Technology and Innovations.</p>

Source: the author.



For more details on these and other support mechanisms in this modality, access the *Eletronic guide* (BRASIL, 2021d).

1.5. Equity



Equity investments in companies can be in the form of Private Equity or Venture Capital. In both cases, investors obtain direct shareholdings in the organizations and their financial contribution helps the organization expand and modernize operations.

Support institutions can even tie the contributions to application in projects for the development and implementation of clean technologies, such as those prioritized in the TNA_BRAZIL project.

Table 12 – General characteristics of the equity modality

EQUITY	
STANDARDIZED AND NON-STANDARDIZED MODALITIES	
Level of accessibility	Limited
Type of support institution	<ul style="list-style-type: none"> Private financial institutions; Development Financial Institutions (DFI).
Type of beneficiary	<ul style="list-style-type: none"> Companies: large, medium and small.
Main barriers	<ul style="list-style-type: none"> Strict selection of projects due to the risks involved; The company must be (or become) a corporation; Dilution of shareholders and accountability to investing partners.
Main advantages	<ul style="list-style-type: none"> Beneficiary gains the know-how of experienced investors to improve company management; Improves the organization's market credibility; The resources can be used for a wide range of purposes.

Source: the author.

Table 13 – Example of an equity mechanism: IFC

INTERNATIONAL FINANCE CORPORATION (IFC) – EQUITY
 <p>It provides long-term investments to private companies that meet the socio-environmental standards set by the IFC. The institution acquires 5% to 20% of the company's shares.</p> <p>APPLICATION OF RESOURCES</p> <p>To be eligible for IFC Equity financing, the company must satisfy the following criteria:</p> <ul style="list-style-type: none">• Be located in a developing country• Be technically viable• Have good prospects for profitability• Benefit the local economy• Be environmentally and socially responsible, satisfying IFC environmental and social performance standards, as well as the standards of the country where it is located <p>The IFC does not lend directly to micro, small and medium companies or individual entrepreneurs, but many of its investment clients are financial intermediaries who can pass resources on to smaller companies.</p> <p>STEPS</p> <p>The company must submit the investment proposal directly to the IFC. After a preliminary review, the IFC may request a detailed feasibility study or business plan to determine whether the company receives the investment.</p>

Source: the author.



For more details on these and other support mechanisms in this modality, access the *Eletronic guide* (BRASIL, 2021d).

1.6. Debt Securities



Debt securities are securities issued by companies or the federal government to raise funds to finance their assets, projects and operations. These funds are raised via the capital market, directly from investors.

There are also convertible debt securities, which are medium and long-term securities that guarantee investors conversion into equity interest, should the issuing company not have the ability to pay on the contract maturity date. The conditions of the issue of

securities, such as terms, yields and conversion into shares, among others, are set out in the contract.


It has become increasingly common to use debt securities to finance projects with environmental benefits, as defined in the securities issuance. These security issuances can be labeled as “Green” by means of independent opinion demonstrating the potential environmental benefits.

Table 14 – General characteristics of the debt securities modality

DEBT SECURITIES	
NON-STANDARDIZED MODALITY	
Level of accessibility	Limited
Type of support institution	<ul style="list-style-type: none"> Investors; Investment funds.
Type of beneficiary	<ul style="list-style-type: none"> Government: Federal; Large and medium companies (publicly traded).
Main barriers	<ul style="list-style-type: none"> Need to become a public limited company (securities).
Main advantages	<ul style="list-style-type: none"> Can provide large amount of capital; Can offer attractive interest rates for long-term financing; Green bonds may have greater interest among investors and investment funds, and may offer even more favorable financing conditions.

Source: the author.

Table 15 – Example of issuance of Klabin debt securities

KLABIN – ISSUANCE OF GREEN BONDS
 <p>Klabin S.A. operates in the paper, cellulose and packaging industry, and is the largest producer and exporter of packaging paper in Brazil. It is also the first company in the sector located in the southern hemisphere to obtain Forest Stewardship Council (FSC) certification. In 2017, the company issued a Green Bond in the total amount of USD 500 million with a 10 year maturity term. The funding received an independent opinion that confirmed the alignment of the issuance with Green Bond Principles (GBP).</p> <p>APPLICATION OF RESOURCES</p> <p>The company establishes eligibility criteria for the projects to be financed, aligned with efforts to reduce the priority environmental impacts of its activities. As defined in their green bond framework, resources should be allocated to the following projects and assets:</p> <ul style="list-style-type: none"> • Sustainable forest management; • Restoration of native forests and conservation of biodiversity; • Renewable energy; • Clean transportation; • Energy efficiency; • Waste management; • Sustainable water management; • Eco-efficient products and/or products adapted to the circular economy; • Adaptation to climate change. <p>STEPS</p> <p>Debt security issuance process in the Brazilian capital market:</p> <ol style="list-style-type: none"> 1. Structuring of the transaction with banks, lawyers, securitization company (when applicable) and fiduciary agent for the development of the deed and registration with the CVM and CETIP; 2. Presentation of the issuance to investors; 3. Liquidation of the issuance. <p>For green certification:</p> <ol style="list-style-type: none"> 1. Inclusion of criteria for characterizing the green bond in the deed; 2. Pre- and post-issue opinions for assessing resource allocation according to the GBP.

Source: the author.



As it is a non-standardized modality, there are no support mechanisms in the *Eletronic guide* to financing options for the prioritized technologies in the TNA_BRAZIL project. For more information on the Green Bond issuance process, access the publication [NÃO PERCA ESTE BOND](#).

1.7. Payment for Environmental Services



Payment for Environmental Services (PES) is a mechanism where services that generate positive environmental impacts are commercialized to foster and finance the protection and conservation of the environment.

In Brazil, there are initiatives by the federal and state governments for payments in exchange for environmental services, mainly for the preservation and/or recovery of native forests.

In 2007, the 13th Conference of the Parties (COP-13) of the United Nations Framework Convention on Climate Change (UNFCCC) agreed that developing countries should be financially supported to make their mitigation actions viable, including combating deforestation and forest degradation and the recovery and expansion of forest cover. In this way, REDD+ (Reducing Emissions from Deforestation and Forest Degradation) has become the main standardized PES mechanism under the UNFCCC.

Table 16 – General characteristics of the payment for environmental services (PES) modality

PAYMENT FOR ENVIRONMENTAL SERVICES	
STANDARDIZED AND NON-STANDARDIZED MODALITIES	
Level of accessibility	Limited
Type of support institution	<ul style="list-style-type: none"> • Large companies; • Governments; • Philanthropic Foundations.
Type of beneficiary	<ul style="list-style-type: none"> • Government: Federal, state and municipal; • Companies: Public, large, medium, small and micro; • Cooperatives; • Associations.
Main barriers	<ul style="list-style-type: none"> • Prove technical capacity to develop studies that demonstrate the provision of the environmental service, with measurable environmental impacts; • Difficulty in developing a system for monitoring, reporting and verifying the impacts of the project.
Main advantages	<ul style="list-style-type: none"> • Non-repayable; • Provision of a Monitoring, Reporting and Verification (MRV) system for positive impacts.

Source: the author.

Table 17 – Example of a PES mechanism: REDD+ in Brazil

REDD+ IN BRAZIL
<p>REDD+ resources are secured by the federal or state government and directed to finance public policies, programs and projects to combat deforestation and forest degradation.</p> <p>In January of 2020, Brazil received USD 96.5 million from the Green Climate Fund (GCF) for the REDD+ results between 2014 and 2015. The funds were used to strengthen the National Strategy for REDD+ (ENREDD+) and the development of the pilot program <i>Floresta+</i> to promote the conservation and recovery of native vegetation. In July of 2020, the Brazilian government made this program permanent with the receipt of an additional contribution of BRL 500 million from the GCF.</p> <p>APPLICATION OF RESOURCES</p> <p><i>Floresta+</i> understands that to achieve effective results, investments in monitoring, surveillance, firefighting, research, tree planting, environmental inventories and agroforestry systems are required.</p> <p>In this context, the technologies prioritized in the TNA_BRAZIL project may be eligible to receive financial resources for silviculture and genetic improvement of native species and mixed planting silviculture for restoration, as long as they generate positive and measurable environmental impacts.</p> <p>STEPS</p> <p>As it was only implemented recently, the procedures for accessing <i>Floresta+</i> resources have not yet been defined. The Brazilian government is working to formalize the economic activity of environmental preservation and recovery by developing measurement methodologies for the program, as well as the creation of the National Registry of Environmental Services.</p>

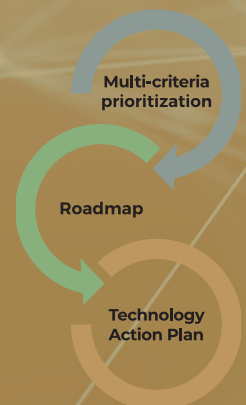
Source: the author.



For more details on these and other support mechanisms in this modality, access the *Eletronic guide* (BRASIL, 2021d).

2.

Electronic guide
to financing
options for the
**technologies
prioritized in the
TNA_BRAZIL
project**



2. ELETRONIC GUIDE TO FINANCING OPTIONS FOR THE TECHNOLOGIES PRIORITIZED IN THE TNA_BRAZIL PROJECT

The Eletronic guide aims to facilitate the search for support mechanisms aligned with the requirements of the Technology Action Plans in the TNA_BRAZIL project. The tool presents relevant information for each mechanism, allowing users to make comparative assessments of financing options.

The tool consists of two main tabs and five other tabs, which serve as help screens, marked in the "Glossário". The first tab includes an introduction, as well as a step-by-step explanation on how to use the tool and filters. The second tab is accessed by clicking on the "Acessar guia" box at the bottom of the first tab. This is found in the main panel of the guide and can be used to search for support mechanisms, according to the procedures described below.

The first help screen, located beside the "Tecnologias" box, gives a brief description of the prioritized technology

packages. The second screen, located beside the "Modalidades de suporte", explains the different types of financing options. There is a help key beside "Acessibilidade dos mecanismos" that describes the level of accessibility (ample, moderate or limited) of each mechanism, according to the methodology described in the previous chapter. The fourth item provides additional information on the selected support mechanism, such as terms, grace period, minimum and maximum financeable amounts, available fund resources and interest rates. Finally, for each support mechanism, you can click on the "Informações de como acessar" box for a step-by-step explanation on how to submit project proposals (if reported in the credit option).

The following is a brief description of the procedures to optimize the use of the Eletronic guide to request funding for project proposals based on the Action Plans in the TNA_BRAZIL project (BRASIL, 2021b; 2021c).

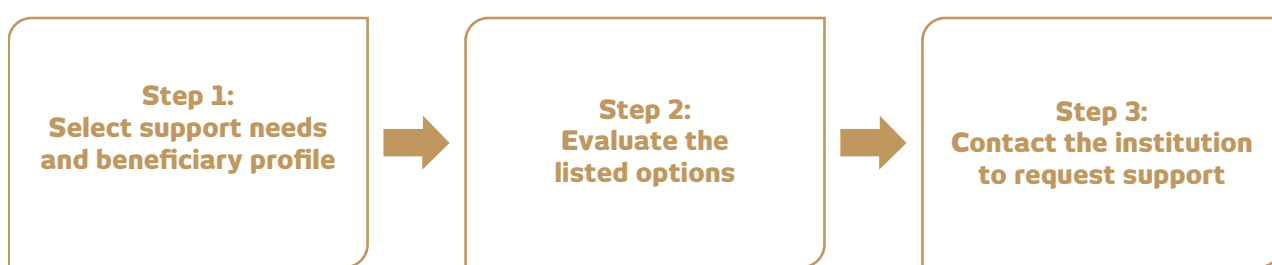


Figure 2 – Step-by-step procedure to use the eletronic guide

Source: the author.

Step 1: Select the technology package of interest that matches your profile

To get the best results when navigating the eletronic guide (main screen below), it is important to understand how the filters work.



Filters

When you open the eletronic guide, none of the fields will be selected and all the mapped mechanisms are shown in the graphics and in the table at the bottom of the page (71 mechanisms). To get more accurate results, the user should select an option in each available criterion. To clear a selection or start over, simply click again on the selected option in any of the filters, or click on the "Limpar filtros" button in the upper left corner to start selecting again.

Limpar filtros

- Select technology and profile:
 - Select technologies of interest

Tecnologia

- Agricultura de precisão
- Aproveitamento de resíduos agrícolas e agroindustriais
- Energia solar fotovoltaica flutuante
- Fogões solares fotovoltaicos com indução
- Indústria 4.0
- Materiais inovadores para cimento
- Melhoramento genético animal na pecuária bovina de corte
- Monitoramento por satélite
- Silvicultura com plantios mistos para restauração
- Silvicultura e melhoramento genético de espécies nativas
- Veículos elétricos a pilha a combustível a etanol
- Veículos híbridos flex

Glossário

- Select the associated sector

Setor

- Agricultura
- Edificações
- Energético
- Industrial
- Pecuária
- Resíduos
- Silvicultura
- Transportes

- Select the type of support you want

Modalidade de suporte

- Assistência técnica
- Empréstimo reembolsável
- Empréstimos não Reembolsáveis
- Garantia
- Pagamentos por serviços ambientais
- Participação societária



Glossário

- Selected the nature of the beneficiary

Natureza do beneficiário

- Associações e cooperativas
- Empresa privada
- Governo

- Select the type of beneficiary

Tipo de beneficiário

- Associação
- Cooperativa
- Empresa de grande porte
- Empresa de médio porte
- Empresa pública
- Estado
- Micro e pequena empresa
- Município
- União

- Select your state or location¹

Estado elegível ou localização do interessado

- Acre
- Alagoas
- Amapá
- Amazonas
- Bahia
- Ceará

- Select the mechanism characteristics:
 - Select the required guarantee(s) for financing

Necessidade de garantia para financiamento

- Garantia determinada caso a caso (Real e/ou Pessoal)
- Não aplicável
- Não informado
- Pessoal

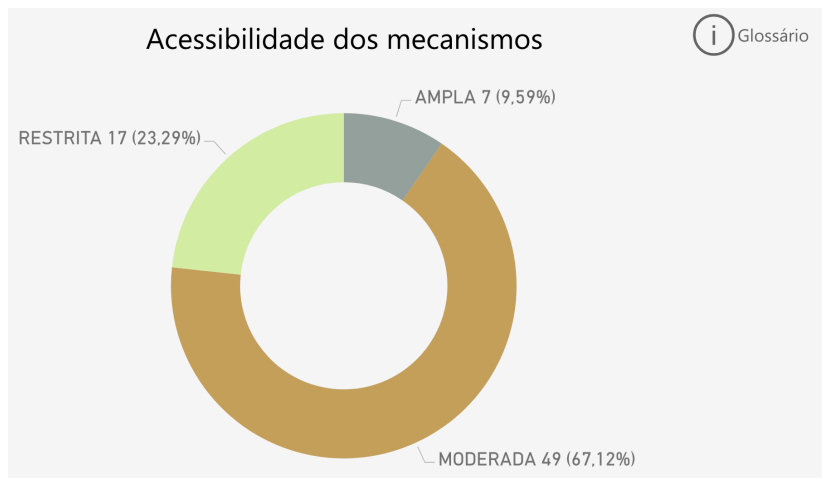
¹ Any state in Brazil can be selected. If you want to select financing options applicable to all states, do not select this option.

Step 2: After selecting, you can evaluate the financing options available (according to the technology and your profile)

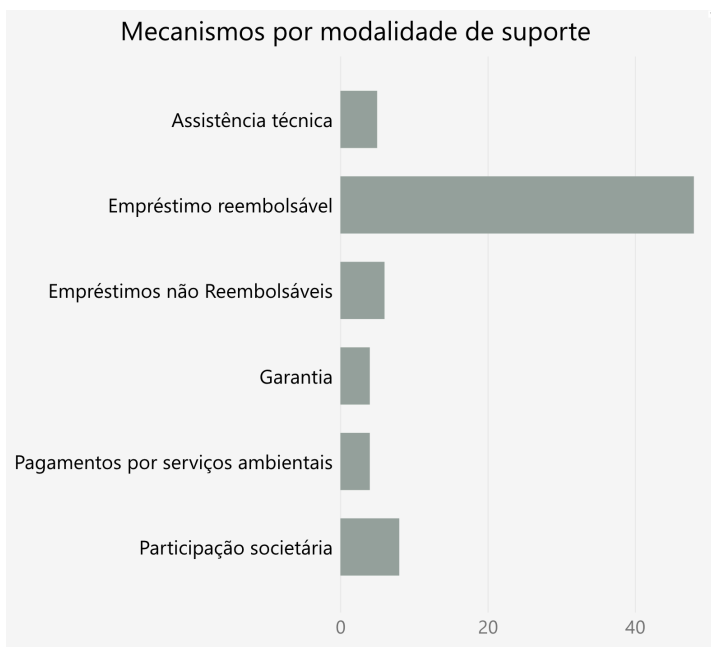
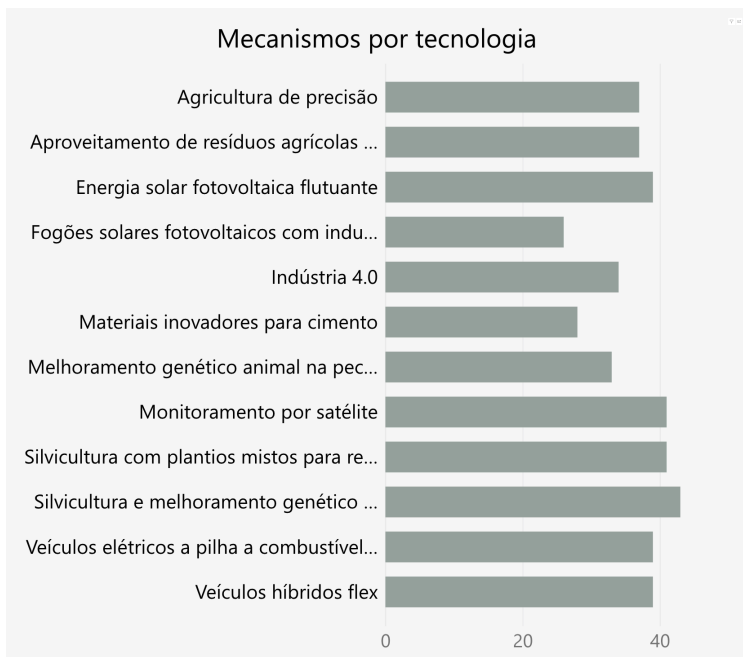
In "Número de mecanismos de financiamento" chart you can see the number of mechanisms available for the selected filters.

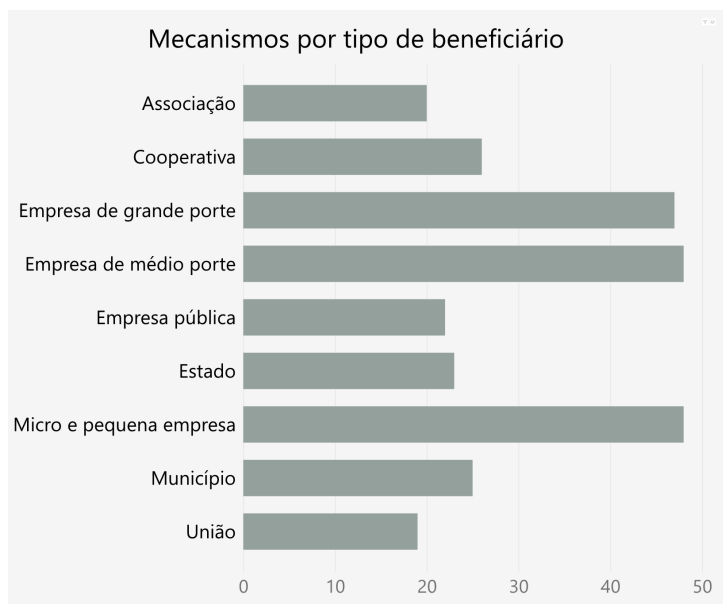


In "Acessibilidade dos mecanismos" chart you can see which mechanisms match your filter selection. Access is rated as "Acessibilidade restrita", "Acessibilidade moderada" and "Acessibilidade ampla."



In the graphics on the right side of the guide, you can see how many mechanisms are available by technology, by type of support and by type of beneficiary, according to the selected filters. Note that the guide selects all available financing options if no profile options are selected in Step 1.





You can find the following information in the table at the bottom of the page:

- Name of mechanism (*Nome do mecanismo*);
- Brief description of the mechanism (*Breve descrição do mecanismo*);
- Eligibility criteria (*Critério de elegibilidade*): necessary prerequisites to access the modality;
- State or location of the interested party (*Estado ou localização do interessado*);
- Contact information (*Dados para contato*).

Para informações adicionais, selecione o mecanismo na tabela abaixo:

Nome do mecanismo	Resumo	Critério de elegibilidade	Estado ou Localização do interessado	Dados para contato
FINEP: Inovared 4.0	Apoia a formulação e implementação de soluções de digitalização que abarquem a utilização, em linhas de produção, de serviços de implantação de tecnologias habilitadoras da Indústria 4.0.	- Empresas brasileiras com receita operacional bruta anual ou anualizada de até R\$ 300 milhões com atividades econômicas nos setores da Indústria da Transformação e da Agricultura - As tecnologias habilitadoras apoiadas no âmbito do Finep Inovared 4.0 estão alinhadas nos seguintes temas: internet das coisas; computação na nuvem; Big Data; segurança digital; manufatura aditiva; manufatura digital; integração de sistemas; digitalização; computação e nuvem; sistema de simulação; robótica avançada; e inteligência artificial.	Todos	http://www.finep.gov.br/fale-conosco
FINEP: IoT	Tem por objetivo geral o desenvolvimento de novos produtos, processos e serviços baseados em tecnologias digitais – tendo como referencial o conceito de Internet das Coisas e demais tecnologias habilitadoras da Manufatura Avançada – com aplicações na saúde, indústria, no agronegócio (ambiente rural) e no desenvolvimento urbano (cidades).	- A empresa deve ter receita operacional bruta anual ou anualizada igual ou superior a R\$ 16 milhões e que submetam propostas com valor mínimo de R\$ 5 milhões. Quando for controlada por outra ou pertencer a um grupo econômico, a classificação de porte considerará a receita consolidada do grupo econômico. - Os Planos Estratégicos de Inovação submetidos devem estar alinhados com um ou mais dos seguintes eixos de atuação: Eixo 1 – Desenvolvimento de soluções digitais baseadas em Internet das Coisas (IoT) e demais tecnologias habilitadoras, visando à integração de ambientes virtuais e físicos nos processos fabris, no agronegócio, no desenvolvimento urbano, na saúde e nas cadeias de serviços.	Todos	internetdascoisas@finep.gov.br

When you identify the most suitable mechanism for your interests, select it from the table. All the graphics on the screen will automatically change, as well as the “*Informações adicionais* – Additional information” table, where you will see the following information:

- Term (*Prazo*)
- Grace period (*Período de carência*)
- Minimum amount (*Valor mínimo*)
- Maximum amount (*Valor máximo*)
- Available fund resources (*Volume de fundos disponível*)
- Interest rates (*Taxa de Juros*)

Informações adicionais: i Glossário	
Escolha o mecanismo de financiamento	Escolha o mecanismo de financiamento
Prazo (meses)	Período de carência (meses)
Escolha o mecanismo de financiamento	Escolha o mecanismo de financiamento
Valor mínimo	Valor máximo
Escolha o mecanismo de financiamento	Escolha o mecanismo de financiamento
Volume de Fundo disponível	Taxa de Juros

After analyzing the conditions of the selected mechanism, the user can click on the “*Informações de como acessar* – Access information” button on the right side of the table at the bottom of the page to get more information on how to request the financing.



Clicking on this button takes you to the “*Informações de como acessar*” help screen, which includes the steps to request funding from the mechanism (see example below).

Passo a passo de como acessar o mecanismo: BNDES: Fundo Clima - Subprograma Energias Renováveis X

Envie sua solicitação de financiamento diretamente ao BNDES através do sistema de Consulta Prévia Eletrônica
[\(https://www.bndes.gov.br/wps/portal/site/home/financiamento/produto/fundo-clima-energias-renovaveis/!ut/p/z1/vZLPk5owFMf_lh44YqIJGntjGCt1cdS1VslIJ4QA6UjCh...\)](https://www.bndes.gov.br/wps/portal/site/home/financiamento/produto/fundo-clima-energias-renovaveis/!ut/p/z1/vZLPk5owFMf_lh44YqIJGntjGCt1cdS1VslIJ4QA6UjCh...)
 Caso o projeto tenha continuidade, será iniciada a etapa de Análise, quando serão solicitadas mais informações/documentos para avaliação do projeto.
 Caso prefira, envie sua solicitação por meio de uma instituição financeira credenciada (agente financeiro público) de sua preferência, segundo as orientações do roteiro de pedido de financiamento (operações indiretas não automáticas).

Step 3: After completing the first two steps, you can contact the institution to start the funding application process. The funder's contact information can be accessed in "Contact details – Dados para contato" in the additional mechanism information box

The following example shows how to use the tool and filters to help you select financing mechanisms for the Action Plans in the TNA_BRAZIL project.

Table 18 – Practical example: use of the tool and accessibility classification

STEP-BY-STEP PROCEDURE TO REQUEST A REPAYABLE LOAN FOR A LARGE COMPANY AND INDUSTRY 4.0 TECHNOLOGY
<p>STEP 1: OPEN THE MAIN PAGE OF THE ELETRONIC GUIDE</p> <ul style="list-style-type: none"> • In "Technology – <i>Tecnologia</i>" select "Industry 4.0 – <i>Indústria 4.0</i>" • In "Support modality – <i>Modalidade de Suporte</i>", select "Repayable loan – <i>Empréstimo reembolsável</i>" <p>See the figure below for this selection:</p> <div style="border: 1px solid #ccc; padding: 10px; margin-bottom: 10px;"> <p>Tecnologia Glossário</p> <ul style="list-style-type: none"> <input type="checkbox"/> Agricultura de precisão <input type="checkbox"/> Aproveitamento de resíduos agrícolas e agroindustriais <input type="checkbox"/> Energia solar fotovoltaica flutuante <input type="checkbox"/> Fogões solares fotovoltaicos com indução <input checked="" type="checkbox"/> Indústria 4.0 <input type="checkbox"/> Materiais inovadores para cimento <input type="checkbox"/> Melhoramento genético animal na pecuária bovina de corte <input type="checkbox"/> Monitoramento por satélite <input type="checkbox"/> Silvicultura com plantios mistos para restauração <input type="checkbox"/> Silvicultura e melhoramento genético de espécies nativas <input type="checkbox"/> Veículos elétricos a pilha a combustível a etanol <input type="checkbox"/> Veículos híbridos flex </div> <div style="border: 1px solid #ccc; padding: 10px; margin-bottom: 10px;"> <p>Modalidade de suporte Glossário</p> <ul style="list-style-type: none"> <input type="checkbox"/> Assistência técnica <input checked="" type="checkbox"/> Empréstimo reembolsável <input type="checkbox"/> Empréstimos não Reembolsáveis <input type="checkbox"/> Garantia <input type="checkbox"/> Participação societária </div> <div style="border: 1px solid #ccc; padding: 10px;"> <p>Número de mecanismos de financiamento</p> <p style="text-align: center;">20</p> </div>

continues

continuation

STEP-BY-STEP PROCEDURE TO REQUEST A REPAYABLE LOAN FOR A LARGE COMPANY AND INDUSTRY 4.0 TECHNOLOGY

STEP 2: YOU CAN EVALUATE THE OPTIONS IN THE TABLE AT THE BOTTOM OF THE PAGE. ONE OF THE OPTIONS IN THE TABLE IS “BNDES FINEM – MEIO AMBIENTE – REDUÇÃO DO USO DE RECURSOS NATURAIS”.

Para informações adicionais, selecione o mecanismo na tabela abaixo:

Nome do mecanismo	Resumo	Critério de elegibilidade	Estado ou Localização do interessado	Dados para contato
BNDES Finem - Meio Ambiente - Redução do uso de recursos naturais	Financiamento a partir de R\$ 10 milhões para investimentos em eficiência e em produtos ou processos que utilizem insumos provenientes de fontes renováveis como matérias primas, ou que possuam um menor impacto ambiental (exclusive cana-de-açúcar)	Podem ser financiados os seguintes empreendimentos: - redução da intensidade do uso de recursos naturais ou substituição de recursos não renováveis por renováveis; - coprocessamento de resíduos (resíduos industriais e materiais inservíveis como substitutos de combustíveis e/ou matérias-primas não renováveis) ou em utilização de biomassa, na produção de cimento; - reciclagem de material plástico pós-consumo; - fabricação de produtos ou desenvolvimento processos que possuam um menor impacto socioambiental do que os existentes; - redução das emissões de GEEs em projetos que - contribuam para as metas da NDC brasileira; - investimentos para implementar diretrizes e melhores práticas identificadas nas Políticas Setoriais Socioambientais do BNDES.	Todos	https://www.bndes.gov.br/wps/portal/site/home/quem-somos/canais-atendimento/fale-conosco-formulario-geral/ Telefone: +55 0800 7026337

The following information will appear in the table:

- Mechanism name (*Nome do mecanismo*): *BNDES Finem – Meio Ambiente – Redução do uso de recursos naturais*
- Summary (*Resumo*): Financing starting at BRL 10 million for investments in eco-efficiency, products and processes that use inputs from renewable sources or with fewer environmental impacts (except sugarcane)
- Eligibility criteria (*Critério de elegibilidade*):
 - o Projects for:
 - Reducing natural resource use, or substituting non-renewable resources with renewable ones;
 - Co-processing of industrial waste, materials (substitutes for fuels and/or non-renewable raw materials), use of biomass in cement production;
 - Post-consumption plastic recycling;
 - Manufacturing of products or development of processes that have fewer socio-environmental impacts;
 - Reduction of GHG emissions in projects that contribute to the Brazilian NDC targets;
 - Implementing guidelines and best practices identified in the BNDES Social and Environmental Sector Policies.
- State or Location of Interested Party (*Estado ou Localização do interessado*): All
- Contact information (*Dados para contato*): <https://www.bndes.gov.br/wps/portal/site/home/quem-somos/canais-atendimento/fale-conosco-formulario-geral/>
Phone: +55 0800 7026337

When you select this mechanism, the “Additional information – *Informações adicionais*” box (above the table) will present the following information:

- Term (*Prazo*): 240 months;
- Grace period (*Período de carência*): 6 months;
- Minimum amount (*Valor mínimo*): BRL 10 million;
- Maximum amount (*Valor máximo*): Up to 80% of the total cost of the project, limited to 100% of financeable items.
- Available fund amount (*Volume de fundo disponível*): Not informed
- Interest rate (*Taxa de juros*): BNDES: LTR (Long term rate) + 0.9% p.a. + Credit risk rate according to the customer’s profile and financing terms. Financial institution accredited by BNDES: LTR + 1.05% p.a. + Financial institution fee negotiated by the client.

Clicking the “Access information – *Informações de como acessar*” button directs you to a new tab with the following information:

- Steps to access the mechanism (*Passo a passo de como acessar o mecanismo*):
 - o Register on the BNDES website (<https://portal.bndes.gov.br/habilitacao/>);
 - o Send basic project information and documents via the Electronic Prior;
 - o Consultation system to verify eligibility for financing;
 - o Send additional information and documents for detailed analysis of the project and credit profile;
 - o If you choose an accredited financial institution to intermediate, all information and documents must be submitted to the institution (to be entered in the system).

continues

continuation

**STEP-BY-STEP PROCEDURE TO REQUEST A REPAYABLE LOAN
FOR A LARGE COMPANY AND INDUSTRY 4.0 TECHNOLOGY**

The “Mechanism accessibility – *Acessibilidade dos mecanismos*” graphic indicate that this mechanism has AMPLE accessibility (see explanation of classification methodology after Step 3)

STEP 3: CONTACT BNDES FOLLOWING THE STEPS DESCRIBED IN THE TOOL.

Source: the author.

**UNDERSTAND THE ACCESSIBILITY CLASSIFICATION OF THE FINANCING MECHANISM
“BNDES FINEM – MEIO AMBIENTE – REDUÇÃO DO USO DE RECURSOS NATURAIS”**

A. Beneficiary profile (*Perfil do beneficiário*): The mechanism is open to all beneficiary profiles (Federal, state and municipal governments, public companies, large, medium, small and micro companies, associations and cooperatives). Thus, according to the methodology, it receives 3 points.

B. Technologies (*Tecnologias*): The mechanism is open to all technologies. Thus, it receives 3 points.

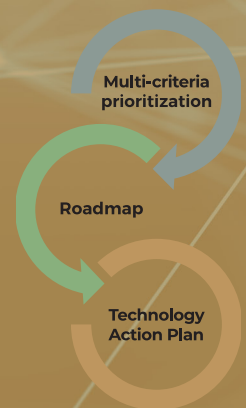
C. Requirements for request support (*Requisitos para solicitação de suporte*): As indicated in the steps to access the mechanism, the client must register with BNDES and submit project information and documents to access eligibility. Thus, it receives 2 points.

With a total of 8 points, the mechanism accessibility is classified as ample.

Source: the author.

3.

Financing mechanisms to promote **the adoption of the Technology Action Plans**



3. FINANCING MECHANISMS TO PROMOTE THE ADOPTION OF THE TECHNOLOGY ACTION PLANS

In this section, we present an overview of the available modalities and support mechanisms to finance the adoption of the Technology Action Plans (TAPs). To better visualize the possibilities to access support, consult the *eletronic guide* (BRASIL, 2021d). In view of the constant updating of the portfolios of national and international financing mechanisms, it is important to note that the information below is subject to change. For this reason, we recommend using the eletronic guide, which is constantly updated.

The TAPs seek to develop and diffuse climate technologies that promote sustainable development. To improve the level of maturity of the technologies, non-repayable loans and technical assistance modalities are most commonly accessed. All the TAPs contain actions and sub-activities with this objective, as well as actions for training and disseminating results to promote technology diffusion. In these cases, the goal is to also implement pilot and demonstration projects to promote the maturation and/or diffusion of technologies already available. When these projects are associated with revenues or cost reductions, repayable loan mechanisms can be accessed. The following are details of the financing options for the action plans:

- The diffusion of precision agriculture requires the creation of a Technology Network to implement pilot demonstration units for agriculture 4.0 technologies, as well as dissemination and training activities on the use of these technologies, especially for small and medium producers. Pilot units demonstrate how to increase agricultural productivity and reduce production costs. Thus, they can be financed with repayable loans if they are transferred to farmers at the end of the implementation of the plan.
- The action plan for industry 4.0 has similar characteristics, as it also seeks to diffuse innovative technologies through activities systematized in a technology network. It involves the implementation of demonstration projects for small and medium companies, in addition to large companies and startups. 4.0 technologies can be transferred at the end of the projects, thus making them eligible for financing with repayable loans. The activities for training human resources and the improvement of infrastructure for industry 4.0 and the circular economy, as well as the creation of the technological network, do not have direct revenues associated with them, which is why they can be financed with non-repayable loan and technical assistance modalities.
- The TAP for use of agricultural and agro-industrial waste involves the implementation of pilot co-digestion plants in integrated and crop rotation systems for the production of electricity, biomethane and biofertilizer. Like the plans mentioned above, the demonstration units have the potential to generate revenues from the sale of products, making them eligible for financing with repayable loans, provided the business model establishes the transfer of technology at the end of the demonstration project.
- The elaboration of a national inventory of floating solar potential requires the collection of data on hydroelectric plant reservoirs. The mapping must be carried out in partnerships with energy companies, providing an important subsidy for the generation of electricity from photovoltaic solar panels. Power generation in reservoirs is, therefore, a possible source of revenue for the partner companies, making the activity eligible for financing with repayable loans.
- In the case of photovoltaic solar induction stoves, repayable loans are a potential financing option if the equipment is purchased by the homeowner at the end of the pilot implementation project. The battery energy storage system can partially satisfy the building's electricity needs, thus reducing the energy costs of LPG and electricity. In a typical residence, with an average monthly electricity consumption of 150 kWh and one 13 kg LPG cylinder (filled every two months), even with the cost to

purchase the system (estimated at BRL 4,900.00) (MCTI, 2021c), the savings in energy costs with the solar system would cover the initial investment in approximately 3 years.

- In the case of flex hybrid buses, the technology can be transferred at the end of the pilot demonstration to the partner company. In this case, the hybridization kit can be funded with resources from the repayable loan mechanism, since the conversion of buses to flex hybrid reduces fuel consumption and fuel costs (compared to diesel buses) due to the greater efficiency of flex hybrid engines.
- With respect to the TAP for mixed planting silviculture for restoration, the pilot demonstration units can be implemented by public and private sectors. In the case of the private sector, companies can use their own resources or access the repayable loan mechanism since there are potential profits from nurseries to supply the commercial planting of exotic and native species.
- In the case of genetic improvement in beef cattle, the actions to characterize beef production and genetics, as well as training and dissemination activities, are intended to promote the development and diffusion of technology, especially for medium and small producers. As these actions do not generate revenues, they must be funded with non-repayable loans and/or technical assistance. Ideally, the platform for integration, dissemination, training and analysis of economic, zootechnical, genealogical and genotype data on beef cattle should be provided free of charge. However, there is nothing to prevent stakeholders from developing the platform for their own use and/or commercialization, allowing them to access the repayable loans modality for financing. This modality offers a greater number of financing options.

1. CREATION OF THE PRECISION AGRICULTURE TECHNOLOGY NETWORK



NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable

TECHNICAL ASSISTANCE

- Latin American Investment Facility (LAIF)
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

2. SUPPORT FOR DEVELOPMENT, INNOVATION AND DIFFUSION



REPAYABLE LOANS (ACTIVITIES 2 AND 3 OF ACTION 2)

- AccessCrédito
- AgeRio Inovação; Sustentabilidade
- Finep Apoio Direto à Inovação (Inovação crítica; Inovação para competitividade; Inovação para desempenho)
- BADESUL ABC program
- BADESUL Inovagro
- BNDES ABC
- BNDES Crédito Serviços 4.0; Finem; Inovagro
- Desenvolve Agro
- EIB Loans (Public and private sector)
- FNE Verde Banco do Nordeste
- FNO ABC/Biodiversidade (Banco do Amazonas)
- Green Climate Fund Loan (Private and public sector)
- IFC Loans
- Latin American Investment Facility (LAIF)

NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable

TECHNICAL ASSISTANCE

- Latin American Investment Facility (LAIF)
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

3. TRAINING AND DISSEMINATION



NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable

TECHNICAL ASSISTANCE

- Latin American Investment Facility (LAIF)
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

Figure 3 – Financing options for precision agriculture TAP actions
Based on MCTI (2021c; 2021d)

1. CIRCULAR ECONOMY AND INDUSTRY 4.0 NETWORK



NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable
- Rota 2030 program

TECHNICAL ASSISTANCE

- Latin American Investment Facility (LAIF)
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

2. DEVELOPMENT OF DEMONSTRATION PROJECTS



REPAYABLE LOANS

- AccessCrédito
- AgeRio Indústria; Inovação; Sustentabilidade
- Finep Difusão Tecnológica; Inovação Crítica; Inovação para Competitividade; Inovação para Desempenho; Inovacred 4.0; IoT
- BNDES Crédito Serviços 4.0; Finem
- EIB Loans (Private and Public Sector)
- Green Climate Fund (Private and Public Sector Loans)
- IFC Loans
- Latin American Investment Facility

NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable
- Rota 2030 program

TECHNICAL ASSISTANCE

- Latin American Investment Facility
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

3. TRAINING OF HUMAN RESOURCES



NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable
- Rota 2030 program

TECHNICAL ASSISTANCE

- Latin American Investment Facility (LAIF)
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

4. INFRASTRUCTURE AND PUBLIC POLICIES



NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable
- Rota 2030 program

TECHNICAL ASSISTANCE

- Latin American Investment Facility (LAIF)
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

Figure 4 – Financing options for industry 4.0 TAP actions
Based on MCTI (2021c; 2021d)

1. POTENTIAL WASTE SUPPLY



NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable
- Finep Rota 2030 program

TECHNICAL ASSISTANCE

- Latin American Investment Facility (LAIF)
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

2. KNOWLEDGE OF PROCESSES



NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable
- Finep Rota 2030 program

TECHNICAL ASSISTANCE

- Latin American Investment Facility (LAIF)
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

3. PILOT APPLICATIONS AND DISSEMINATION



REPAYABLE LOANS

- AccessCrédito
- AgeRio Inovação; Sustentabilidade
- BNDES Finem Geração de Energia; Meio Ambiente; Fundo Clima Energias Renováveis e Projetos Inovadores; Cidades Inteligentes e Projetos Sustentáveis
- BRDE Energia Renovável e Infraestrutura
- Clean Technology Fund
- Desenvolve SP
- EIB Loans (Private and Public Sector)
- Finep Difusão Tecnológica; Inovação Crítica; Inovação para Competitividade; Inovação para Desempenho;
- FNE Banco do Nordeste
- Green Climate Fund (Private and Public Sector loans)
- IFC Loans
- Latin American Investment Facility

NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable
- Finep Rota 2030 program

EQUITY

- ECO Enterprises Fund II
- Finep FIP Inova Empresa
- Fundo CRIATEC III
- Green Climate Fund (Equity)
- IFC Equity
- Latin American Investment Facility
- OikoCredit Equity
- Primatec

TECHNICAL ASSISTANCE

- Latin American Investment Facility
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

Figure 5 – Financing options for use of agricultural and agro-industrial waste TAP actions
Based on MCTI (2021c; 2021d)



Figure 6 – Financing options for floating solar TAP actions
Based on MCTI (2021c; 2021d)

1. STOVE DESIGN AND SELECTION OF THE IMPLEMENTATION LOCATION



NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable

TECHNICAL ASSISTANCE

- Latin American Investment Facility (LAIF)
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

2. DEVELOPMENT AND TESTING OF PROTOTYPE SOLAR INDUCTION STOVE SYSTEMS



REPAYABLE LOANS

- AccessCrédito
- AgeRio Inovação; Sustentabilidade
- BNDES Finem
- EIB Loans (Public and private sector)
- Finep Apoio Direto à Inovação (Inovação para competitividade; Inovação crítica; Inovação para desempenho)
- FNE Verde Banco do Nordeste
- Green Climate Fund Loan (Private and public sector)
- IFC Loans
- Latin American Investment Facility (LAIF)

NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable

TECHNICAL ASSISTANCE

- Latin American Investment Facility (LAIF)
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

3. PILOT IMPLEMENTATION AND DISSEMINATION OF RESULTS



NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable

TECHNICAL ASSISTANCE

- Latin American Investment Facility (LAIF)
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

Figure 7 – Financing options for photovoltaic solar induction stove TAP actions
Based on MCTI (2021c; 2021d)

1. SELECTION OF MUNICIPALITY AND CHARACTERISTICS



NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable
- Rota 2030 program

TECHNICAL ASSISTANCE

- Latin American Investment Facility (LAIF)
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

2. CONSTITUTION OF THE INTEGRATED TECHNOLOGY SYSTEM (ITS)



REPAYABLE LOANS

- AccessCrédito
- AgeRio Indústria; Inovação; Sustentabilidade
- Finep Difusão Tecnológica; Inovação Crítica; Inovação para Competitividade; Inovação para Desempenho; Inovacred 4.0; IoT
- BNDES Crédito Serviços 4.0; Finem
- EIB Loans (Private and Public Sector)
- Green Climate Fund (Private and Public Sector loans)
- IFC Loans
- Latin American Investment Facility

EQUITY

- FIP Inova Empresa
- Green Climate Fund (Equity)
- IFC Equity
- Latin American Investment Facility
- Primatex

TECHNICAL ASSISTANCE

- Latin American Investment Facility
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

3. ELABORATION AND IMPLEMENTATION OF HYBRIDIZATION KITS



NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable
- Rota 2030 program

TECHNICAL ASSISTANCE

- Latin American Investment Facility (LAIF)
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

REPAYABLE LOANS

- AccessCrédito
- AgeRio Inovação; Máquinas e Equipamentos; Sustentabilidade
- BNDES Finem; Fundo Clima
- BRDE Cidades Inteligentes; Energia Renovável
- Clean Technology Fund (CTF)
- Desenvolve SP Economia Verde
- EIB Loans (Private and Public Sector)
- Finep Inovação Crítica; Inovação para Competitividade; Inovação para Desempenho
- FNE Verde Banco do Nordeste
- Green Climate Fund (Private and Public Sector loans)
- IFC Loans
- Latin American Investment Facility

4. PILOT IMPLEMENTATION, DISSEMINATION AND TRAINING



NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable
- Rota 2030 program

TECHNICAL ASSISTANCE

- Latin American Investment Facility (LAIF)
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

Figure 8 – Financing options for flex hybrid vehicle TAP actions
Based on MCTI (2021c; 2021d)

1. REGULATORY, INFRASTRUCTURE AND RESEARCH INSTRUMENTS



NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable

TECHNICAL ASSISTANCE

- Latin American Investment Facility (LAIF)
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

2. FIELD VALIDATION OF MIXED PLANTING SYSTEMS



NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable

TECHNICAL ASSISTANCE

- Latin American Investment Facility (LAIF)
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

3. PILOT DEMONSTRATION UNITS AND DISSEMINATION OF MIXED PLANTING



REPAYABLE LOANS

- AccessCrédito
- AgeRio Inovação
- BADESUL ABC
- BNDES ABC; Finep; PRONAF ECO
- Desenvolve SP Economia Verde; Agro
- EIB Loans (Private and Public Sector)
- Finep Inovação Crítica; Inovação para Competitividade; Inovação para Desempenho;
- FNE Banco do Nordeste
- FNO ABC/Biodiversidade; Amazônia Sustentável
- Forest Investment Program (FIP)
- Green Climate Fund (Private and Public Sector loans)
- IFC Loans
- Latin American Investment Facility

NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable

TECHNICAL ASSISTANCE

- Latin American Investment Facility
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

Figure 9 – Financing options for mixed planting silviculture for restoration TAP actions
Based on MCTI (2021c; 2021d)

1. PRODUCTION AND ECONOMIC CHARACTERIZATION OF BEEF PRODUCTION



NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable

TECHNICAL ASSISTANCE

- Latin American Investment Facility (LAIF)
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

2. CHARACTERIZATION OF SUPPLY AND DEMAND OF GENETIC MATERIAL AND RESOURCES



NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable

TECHNICAL ASSISTANCE

- Latin American Investment Facility
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

3. QUANTIFICATION OF ECONOMIC BENEFITS OF GENETIC IMPROVEMENT



NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable

TECHNICAL ASSISTANCE

- Latin American Investment Facility (LAIF)
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

4. PLATFORM FOR GENETIC IMPROVEMENT DATA ANALYSIS AND REPORTING



NON-REPAYABLE LOANS

- Green Climate Fund (Donations)
- BNDES Fundo Social
- Special Climate Change Fund (SCCF)
- Latin American Investment Facility
- Finep non-repayable

TECHNICAL ASSISTANCE

- Latin American Investment Facility (LAIF)
- Climate Technology Centre and Network
- IFC Advisory Platform
- BID Technical Cooperation

REPAYABLE LOANS

- AccessCrédito
- AgeRio Inovação; Sustentabilidade
- BADESUL ABC; Inovagro
- BNDES ABC; Finem; Inovagro
- Desenvolve Agro
- EIB Loans (Private and Public Sector)
- Finep Inovação Crítica; Inovação para Competitividade; Inovação para Desempenho
- FNO ABC Biodiversidade; Amazônia Sustentável
- Green Climate Fund (Private and Public Sector loans)
- IFC Loans
- Latin American Investment Facility

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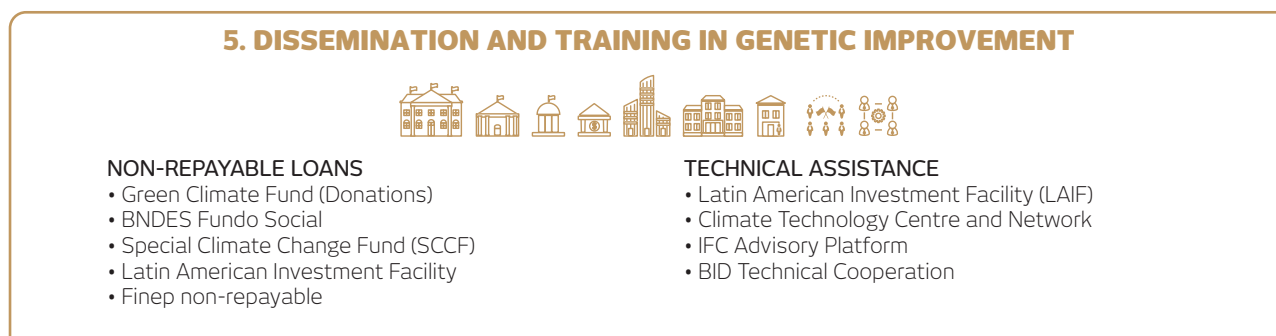


Figure 10 – Financing options for genetic improvement in beef cattle TAP actions
Based on MCTI (2021c; 2021d)

The TAPs for satellite monitoring, silviculture and genetic improvement of native species, innovative materials for cement and ethanol fuel cell electric vehicles involve actions and activities that are strictly aimed at technological development. In other words, they aim to advance the technology readiness level of these technologies to attain commercial maturity in 2030. Thus, it is a question of ensuring the adoption of research and development actions to demonstrate the technologies have economic viability.

In the absence of economic gains during the implementation period of the plans, activities must be funded by

non-repayable loan and technical assistance mechanisms. Increasingly, access to these mechanisms has become a limiting factor for the adoption of technological development projects, given the growing competition for access to these resources and the complexity involved in the elaboration of project proposals.

The next section addresses this topic. It presents the obstacles and conditions to access financing that stakeholders interested in adopting the plans may encounter.

FINANCING OPTIONS

Non-repayable loans: Green Climate Fund (Donations); BNDES Fundo Social; Special Climate Change Fund (SCCF); Latin American Investment Facility; Finep non-repayable; Rota 2030 program

Technical assistance: Latin American Investment Facility (LAIF); Climate Technology Centre and Network; IFC Advisory Platform; BID Technical Cooperation



SATELLITE MONITORING

ACTIONS TO BE FINANCED

- Committee for satellite monitoring systems for land use and land cover
- Automatic classification of land use and land cover monitoring with satellite images
- Development and provision of high resolution monitoring system
- Development and provision of territorial intelligence system
- Dissemination and training on the use of territorial intelligence and monitoring systems

SILVICULTURE AND GENETIC IMPROVEMENT OF NATIVE SPECIES

ACTIONS TO BE FINANCED

- Evaluation of technological properties and market acceptance of juvenile wood from native species
- Combined provenance-progeny tests in experimental units
- Implementation of seed production plantations
- Studies of seeds and seedlings to improve performance in the field
- Mineral nutrition programs for seedlings in the nursery and trees in the field
- Silviculture and genetic improvement strategies
- Development and provision of extension and training

INNOVATIVE MATERIALS FOR CEMENT

ACTIONS TO BE FINANCED

- Selection of potential materials to replace clinker in cement
- Development and testing of new cement formulations
- Technical, economic and environmental assessment of developed and tested innovative cements
- Training and dissemination of TAP results

ETHANOL FUEL CELL ELECTRIC VEHICLES

ACTIONS TO BE FINANCED

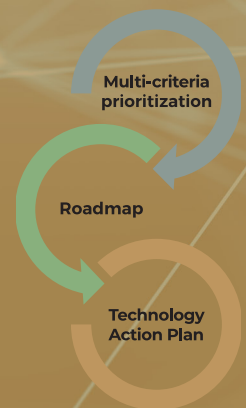
- Laboratory-scale manufacturing of fuel cell components
- Assembly and activation of the stacks with the balance of plant auxiliary systems for the first prototype
- Semi-industrial manufacturing of pilot prototype systems
- Assembly of stacks and auxiliary systems in vehicles for pilot testing

Figure 11 – Financing options for TAP actions for satellite monitoring, silviculture and genetic improvement of native species, innovative materials for cement and ethanol fuel cell electric vehicles

Based on MCTI (2021c; 2021d)

4.

Barriers and conditions to access financing



4. BARRIERS AND CONDITIONS TO ACCESS FINANCING

Although there are many national and international financing mechanisms, access to credit can have barriers and conditions linked to the nature of the financeable product, the size of the company, economic and financial criteria and social and environmental safeguards, among others.

In the case of the TAPs proposed in the TNA_BRAZIL project, the challenge is even greater, given uncertainties with respect to the maturation period of the technologies at different levels of readiness, as well as the amount of financing, which was estimated at BRL 328 million by 2030 (MCTI, 2021c). Technologies like ethanol fuel cell vehicles, innovative materials for cement, silviculture and genetic improvement of native species require investments in research and development (R&D) to reach a degree of maturity for economic results. They are low-carbon solutions with a higher degree of risk that require financing from modalities that have more limited credit options, considering that the main promoter of these mechanisms is the government.

At the macro level, it has become common to require that actions comply with the objectives of preserving environmental, social and environmental integrity, as well as satisfying gender and economic policies, and any other policies established by project financing entities. Social and environmental safeguards must be included in projects, with a view to guiding their implementation in order to minimize, mitigate, compensate and monitor potential negative impacts. If it is not feasible to avoid them, they must describe possible adverse environmental and social impacts well before the commitment to financing, and analyze potential technical, economic and social alternatives. Generally, minimum standards are required for projects in the following areas: i) social and environmental impact assessments; ii) natural ecosystems; iii) pest management; and iv) physical cultural resources (FUNBIO, 2013).

In addition to the requirement for safeguards, barriers tend to hinder access to credit for climate technology projects. There are internal barriers in companies for the development and financing of projects, as well as internal barriers in financial institutions, as summarized in Table 19 (CEBDS, 2014; CNI, 2016; 2020).

Interest and credit are relevant factors that can hinder the competitiveness of industrial sectors in Brazil (FIESP, 2011). High interest rates and spreads make credit more expensive and limited, which, combined with the high and growing tax burden, discourages investments in fixed capital.

According to the CNI (2020), many companies encounter difficulties to get approvals for R&D projects from company executives, especially for innovative technologies like Industry 4.0. Research carried out by the CNI also demonstrates that many executives fail to see the importance and benefits of these technologies, or opt for simpler alternatives to increase profits.

With respect to innovative technologies, such as precision agriculture, ethanol fuel cell electric vehicles and industry 4.0, there is a shortage of resources and financing directed to these technologies. In many cases, the financial institution is not able to adapt and align credit mechanisms fast enough to keep pace with innovations in climate technologies.

Even if innovation provides ongoing competitive advantages, company executives tend to prefer short-term results and opt for other more relevant and priority investment projects. Thus, projects in other areas, such as investments in sales, expanding production or marketing, among others, take on greater importance (CNI, 2020).

Companies have a constant need of financial resources, whether to create sales channels, modernize processes, expand production, comply with regulations, maintain machinery or expand and adapt logistics, among the many other demands for financial resources. In view of the large number of projects that require resources, investments in R&D are not properly prioritized. Thus, the lack of financial resources for investment in companies, together with the lack of adequate mechanisms for financing innovation projects, is another significant constraint on investments in climate mitigation technologies.

In the case of national funding mechanisms, loans for less than BRL 10 million from the National Bank for Economic and Social Development (BNDES) – an amount considered high for a small or medium-sized company – are only obtained through authorized BNDES financial agents, which charge high intermediation fees. Other

BNDES financing mechanisms, such as *FINAME Máquinas 4.0* and *Serviços 4.0*, despite the importance of these programs for the modernization of Brazilian industry, have relatively high rates compared to international market rates and the Brazilian Central Bank's Selic rate. To make investments in the strategic areas prioritized in the TAPs viable, especially considering the long-term return on investment and the amount of investments required, it may be necessary to seek resources that equalize the interest rates practiced by the Bank.

In the case of financing mechanisms offered by the Financier of Studies and Projects (Finep), such as *Finep IoT* and *INOVACRED 4.0*, the conditions are aligned with the characteristics of 4.0 projects with regard to financing costs, grace periods, payment and guarantees (especially *INOVACRED 4.0*). The only obstacle is the requirement of a Federal Tax Clearance Certificate from the borrower to obtain financing.

Table 19 – Internal barriers to the development of R&D projects by companies and credit from financial institutions

COMPANY BARRIERS	FINANCIAL INSTITUTION BARRIERS
<ul style="list-style-type: none"> • Competition for capital costs (investment) with other projects that offer short-term returns • Uncertainty associated with the development and diffusion of technology • Poor ability to identify opportunities and execute R&D projects • Different priorities in internal areas of companies • Risk aversion to R&D projects and investments • Difficulty in preparing environmental and social safeguard plans • Difficulty in preparing risk and contingency plans for the execution of projects • High degree of bureaucracy to elaborate and submit proposals for financing • Ignorance of the benefits of climate technologies • Difficulty getting approval from company executives for projects aimed at the adoption of innovative technologies • High interest rates charged by national development bank mechanisms (compared to international development financing) 	<ul style="list-style-type: none"> • High transaction costs for evaluating and financing projects for innovative technologies, compared to other products • High perception of project risks • Lack of incentive and/or knowledge among credit, product and business staff with respect to innovative climate technologies • Aversion to instruments and contract models (performance, guarantees) • Funding requirements make loans unfeasible • Difficulty in monitoring and evaluating compliance with environmental and social safeguard measures • Difficulty in monitoring the implementation and impacts of projects • High fees charged by financial intermediaries to grant resources from development banks • High interest rates and administrative costs associated with the operation • Difficulty in raising funds for specific financing for climate technologies • Complexity of financing mechanisms for innovative technologies

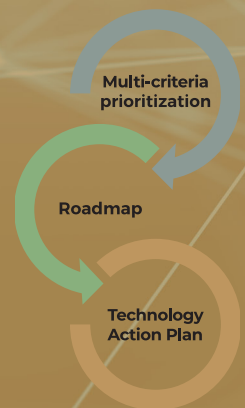
Based on CEBDS (2014); CNI (2016; 2020)

To better understand social and environmental safeguards, the TAPs present a matrix of expected benefits from the development and diffusion of the prioritized technologies. Typically, they describe the potential for reducing emissions for each plan, as well as a qualitative analysis of the potential for job and income generation, the technological readiness level to be achieved, and health and ecosystem co-benefits. However, this qualitative assessment should be improved with impact indicators, a responsibility that falls on the stakeholders interested in implementing the plans.

A number of other instruments can assist in overcoming barriers to financing for the prioritized technologies, including:

- Reduction of bureaucracy in credit operations, simplifying documents necessary for financing, developing new guarantee mechanisms and improving coordination in the financing system;
- Creation of simplified documentation models in accordance with loan values in credit operations;
- Lower financing interest rates for the current lines of financing for research, development and innovation (RD&I) projects, with interest rates equal to, or lower than, the inflation rate;
- Adaptation and development of financing products that take into account the characteristics of the TNA_BRAZIL project TAPs;
- Development of a registration system shared between development institutions and the creation of a pre-registration system for projects;
- Lower administration fees and IOF charges for credit operations to finance the technologies prioritized in the TNA_BRAZIL project;
- Provision of training activities for the preparation of project proposals on climate technologies for submission to national and international mechanisms;
- Increased funding from non-conventional sources, such as green bonds;
- Ensure greater role of private banks and the capital market for projects involving technologies to promote sustainable development;
- Structure a large and liquid secondary market for bank long term funding instruments, in addition to private securities (such as debentures) and bank credit;
- Develop and disseminate guides to facilitate access to national and international financing mechanisms for the public, private and financial market sectors;
- Public and private sectors training to include in their project proposals potential impact criteria; potential for paradigm shift; potential for sustainable development; potential technological and socioeconomic benefits for the country; efficiency and effectiveness; and risk and contingency matrix for project activities.

Conclusions



Conclusions

This document presents modalities to support the implementation of climate technologies, as well as the steps to use the electronic guide to promote the adoption of the technologies prioritized in the TNA_BRAZIL project. In addition, it describes the 71 mapped financing mechanisms and the potential for implementing the different actions and activities proposed in the TAPs (BRASIL, 2021b; 2021c).

While the electronic guide is an important tool to support the process of formulating good project proposals for climate technologies, it should be noted that this guide requires constant revisions due to changes in financing lines. To this end, the National Directorate of the TNA_BRAZIL project has ensured that MCTI servers will carry out the updates, providing sustainability to the initiative funded with GCF resources.

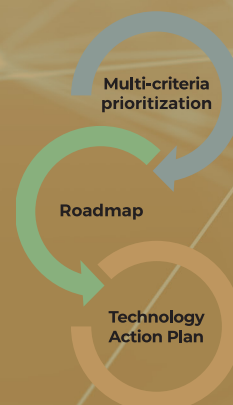
There are two perspectives that need to be taken into account when financing low-carbon technologies that promote sustainable development: the generation of gains for society and the need to mitigate risks for investors. To address this reality, it is essential to design proposals that generate attractive projects, both for the stakeholders interested in developing and diffusing technologies that are socially and environmentally sustainable, as well as for the investors who finance these projects. Projects must be able to deliver the expected results, respecting environmental and social safeguards, and contribute to sustainable development.

It is in this context that the Technology Action Plans of the TNA_BRAZIL project (2021c) were elaborated, and this document presents relevant subsidies to promote financing for the development and diffusion of these climate technologies in Brazil.

The TAPs seek to develop and diffuse technology packages that promote sustainable development. To improve the maturity level of these technologies, especially when still incipient, financing with non-repayable loans and technical assistance is recommended. The TAPs contain actions and sub-activities with this goal, as well as training and dissemination of results to promote technological diffusion. In addition, many of the TAPs involve the implementation of pilot demonstration projects aimed at promoting the development and/or diffusion of technologies already available commercially. In these cases, there are more financing options, since repayable loan mechanisms can be used. With these subsidies, it is understood that stakeholders will be able to effectively promote sustainable low carbon development and resilience to climate change.

Finally, even though the electronic guide presents a wide range of mechanisms that can be accessed to finance the prioritized technologies, it also emphasizes that access to financing is not without barriers and conditions that need to be considered. The guide seeks to describe these challenges and propose measures to mitigate them.

Glossary of terms



Glossary of terms

Paris Agreement is an agreement under the United Nations Framework Convention on Climate Change (UNFCCC) on measures to reduce greenhouse gas emissions starting in 2020 and aimed at limiting the global temperature increase to less than 2°C, and preferably less than 1.5°C. The agreement was discussed at the COP21 in Paris and approved on December 12, 2015.

Associations are private non-profit entities, formed by a group of people for a common objective, without an interest in sharing financial results between them. All incomes from its activities are reverted to the fulfillment of its statutory objectives.

Barriers are all requirements or characteristics that limit, prevent or hinder access to support modalities.

Beneficiary is the organization that will receive financing from the support institution, after all applicable procedures have been completed.

CETIP (Central de Custódia e Liquidação Financeira de Títulos) is a publicly traded finance service company that offers registration, custodian, transaction and liquidation services for assets and securities.

Commercial banks are private or public financial institutions whose main objective is to provide resources to finance, in the short and medium term, trade, industry, service providers, individuals and third parties in general. They must be legally constituted as a corporation.

Concessional Repayable Loans (soft loans) are loans with more favorable conditions than those of the market, characterized by low interest rates (or zero interest), longer payment schedule and/or grace period.

Cooperative is a voluntarily autonomous association of people who work together to satisfy common economic, social and cultural needs and aspirations, in a collectively and democratically managed company.

Credit profile is the assessment of the payment potential of the applicant for a financial transaction, such as a repayable loan, guarantee etc.

CVM (Comissão de Valores Mobiliários) is an autarchy linked to the Ministry of Economy of Brazil that governs the operations of the securities market. The CVM is empowered to discipline, normalize and monitor the performance of the different market members.

Development Financial Institution (DFI) is an institution that provides resources to finance programs and projects in the medium and long term that promote development, especially for the private sector.

Eligibility Criteria are the prerequisites that have to be met to access the support modality.

Grace period is the period during which the beneficiary only pays the interest on contracted financing, without amortizing the amount provided by the support institution.

Guarantees are formal commitments where the guarantor assumes obligations to the financier in the case of non-payment or non-fulfillment of the beneficiary's responsibilities.

Interest rate is a compensation paid by the borrower for the use of money until the day of repayment. The lender, on the other hand, is compensated for not being able to use that money until it is repaid, and for assuming the risk of not be repaid (default).

Philanthropic Funds are funds created to receive donations to support specific causes or organizations.

Private Equity is a type of investment, usually in companies that are not yet on the stock exchange, with the aim of injecting resources to develop the company. This investment occurs through the acquisition of part of the company.

Public Company is a private company administered exclusively by public powers, instituted by a state entity with the purpose provided under law and the sole property of the State. The purpose may be an economic activity or the provision of public services.

Sector it is a segment of the economy with similar economic activities. A sector generally refers to a large segment of the economy, such as agriculture, energy, mining, tourism etc.

Securities are predominantly shares, debentures (credit title of a loan that a company makes to the market) and quotas in investment funds.

Size of Beneficiary Company is the classification of an organization according to its annual gross operating revenues. Companies are classified as follows:

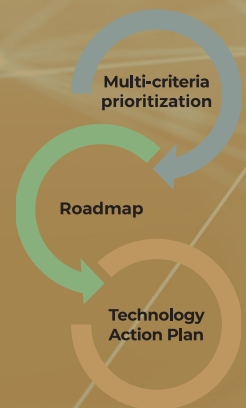
- Micro – up to BRL 360,000;
- Small – BRL 360,000 to BRL 4.8 million;
- Medium – BRL 4.8 million to BRL 300 million;
- Large – more than BRL 300 million.

Steps to access financing are the detailed steps and procedures for requesting support according to the mechanism or modality.

Support Institution is an institution that acts as an intermediary between the beneficiary and some type of financial market service, such as investments, loans, financing, guarantees etc.

Venture Capital it is a type of investment aimed at supporting companies via the purchase of a shareholding. This financing is associated with new or expanding companies.

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