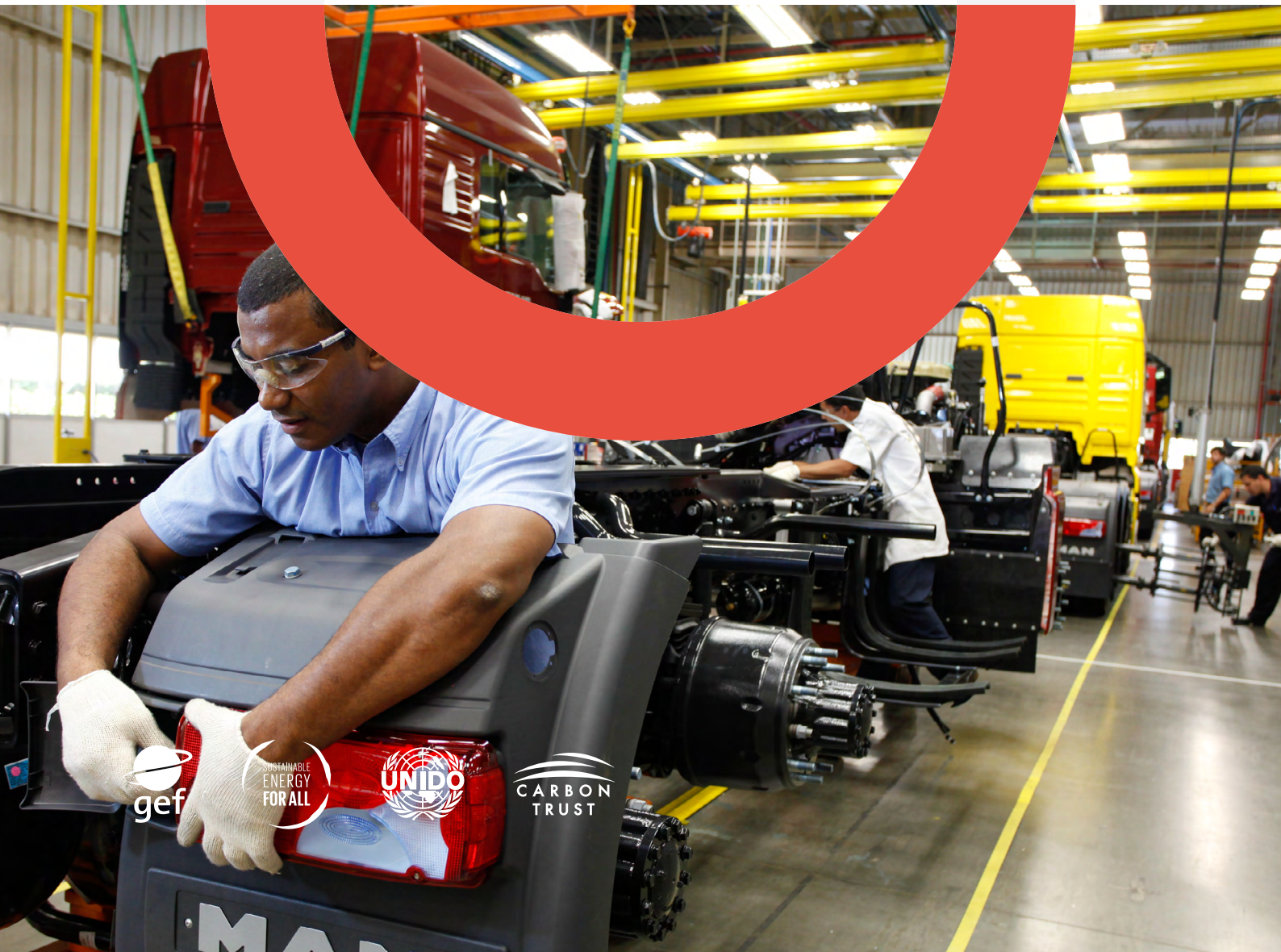
INDUSTRIAL
ENERGY
ACCELERATOR
BRAZIL

Industrial Energy Accelerator
BRAZIL Diagnostic



About the Industrial Energy Accelerator

In partnership with key government agencies and industry stakeholders, the Industrial Energy Accelerator works on the ground to rally government, industry and finance around solutions that ignite change in industries. We then take our knowledge and experience to the world, sharing what we have learned to inspire a global movement for industrial energy efficiency. We currently operate in Indonesia, China, Mexico, Brazil and Morocco, five major industrial countries responsible for around 26% of the world's energy consumption.

To learn more visit our web: **www.industrialenergyaccelerator.org**

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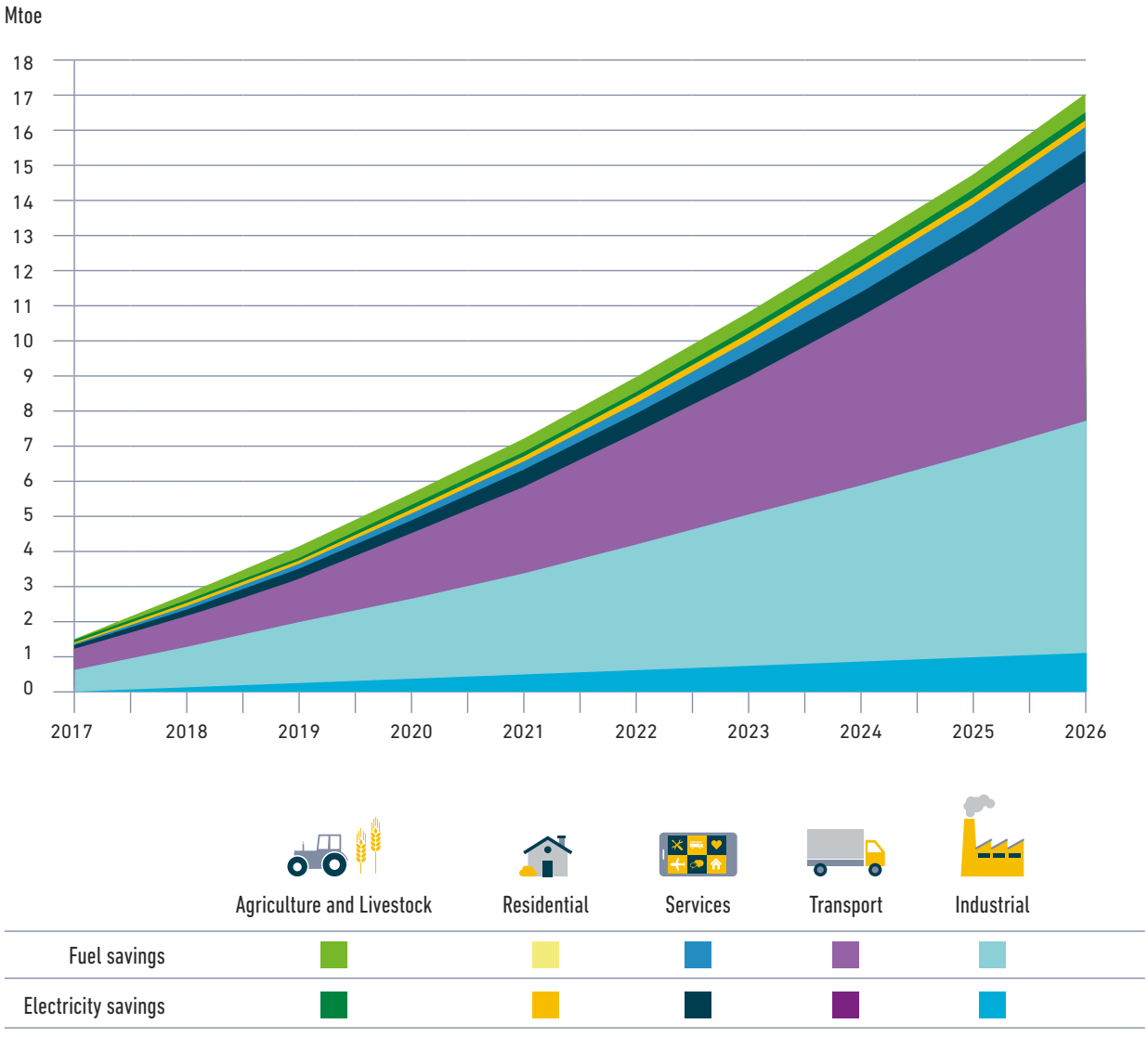
Primary export sub-sectors, such as agriculture and livestock, mining and paper and pulp, will benefit from the natural Brazilian competitiveness as well as from low exchange rate to increase their outputs at higher-than-average rates and hence increase their current shares in energy consumption.

What is the target market?

Industries are responsible for 21% of Brazil's GDP (IBGE, 2018); 35% of the country's total energy consumption (EPE, 2017); and 8% of its GHG emissions (SEEG, 2018).

These shares are expected to remain relatively stable up until 2030, although there is significant potential for energy efficiency (EE) savings throughout industrial sub-sectors. Official government projections for energy demand between 2016-2026 are presented in the country's latest 10-year-energy plan (MME, 2017), where a projected baseline is compared against an efficient scenario in which 17 Mtoe/year are saved across all economic sectors by 2026 - 5.6% less than the baseline in that year.

Figure 1 dissects Brazil's EE potential per economic sector and across fuel and electricity savings. It reveals that approximately 48% of such savings could come from industries, primarily in the form of fuel savings.



Source: (MME, 2017)

Figure 1. Brazil's EE potential onto 2026 per economic sector (Mtoe)

Are there drivers to action?

Brazil has a number of governmental plans and regulations that bear relevance to industrial energy efficiency (EE), most are non-compulsory and lack targets.

Table 1 summarizes the existing plans at federal level, cross-sector federal programmes as well as policies specifically addressed to the industrial sector. An assessment of such drivers reveals that Brazilian industries lack regulatory incentives to become more efficient. Programmes with greatest impact are mostly focused on electricity savings and consumer goods; leave the vast majority of the industrial thermal EE opportunity untapped.

TABLE 1. Summary of EE existing plans and regulations

NAME OF LEGISLATION	KEY TARGETS/SUMMARY
FEDERAL PLANS	
NCD	Mitigate 37% of GHG emissions in relation to 2005 levels by 2025
	Reduce electricity demand by 10% by 2030 against a baseline in line with National EE Plan
National Plan on Climate Change (PNMC)	Mitigate 36% - 39% GHG emissions by 2020 - against a baseline
National Energy Efficiency Plan	Reduce electricity demand by 10% by 2030 against a baseline
Plano Brasil Mais Produtivo (P+B Plan)	No targets - technical assistance provided to 48 industrial SMEs to identify EE opportunities, aiming to scale up to 400 SMEs
Inova Plan	No targets - seeks to accelerate innovation in specific sectors offering credit and grants through periodic public tenders

NAME OF LEGISLATION	KEY TARGETS/SUMMARY
CROSS-SECTOR FEDERAL PROGRAMMES	
ANEEL's EE Programme (PEE)	No targets - EE obligation scheme mandating electricity distribution utilities to invest 0.5% of their net revenues in end-user EE adding to R$630million/ year
Equipment Labelling Programme (PBE)	No targets - mandatory labels to communicate the relative efficiency of electric equipment to consumers
National Programme for Electricity Conservation (PROCEL)	No targets - awareness raising initiatives around EE in multiple sectors and a flagship labelling award for the most efficient equipment under each category of the PBE
National Program for the Rational Use of Oil and Gas Products (CONPET)	No targets - mandatory labels to communicate the relative efficiency of fossil-fuel-powered equipment to consumers
Govt. Sustainable Purchase Programme	No targets - non-compulsory sustainable procurement guidance to federal and state institutions
CROSS-SECTOR FEDERAL REGULATION	
Energy Efficiency Law	Determines minimum efficiency standards for a range of energy consuming product categories
CROSS-SECTOR FEDERAL REGULATION	
Petrobras' operational EE programme	No targets - in-house measures to enhance the efficiency of the company's fossil extraction, refining, distribution, petrochemicals and biofuels - set as a regulation given the company's public status

Source: Schinke and Klawitter, 2016, GIZ, 2016a and AMEE, n.d.

Is there a supply chain for energy efficiency?

Brazil has a relatively weak supply chain for industrial EE, lacking access to finance and technical capacity around industrial fuel savings, where opportunities are greatest. Financial instruments are available to support EE investments, but are generally unattractive due to a number of constraints laid out below. The few existing technical assistance (TA) initiatives have relatively small scales and have had very limited impact in terms of actually unlocking EE investments.

Supply chain and energy efficiency market

Amongst those who can create and service a pipeline of EE projects, Brazil has a limited number of companies and individuals with industrial EE expertise, and an even more limited number of these have access to finance, thereby being able to offer turn-key EE solutions to industries. Amongst institutions, Brazil's ESCO association (ABESCO) is composed of: 60 small energy service companies primarily focused on equipment maintenance and minor power-saving EE interventions within the commercial sector; 7 energy service companies with expertise to deliver investment-grade energy audits and deeper EE interventions - although again mostly focused on power savings and with limited experience in the industry; and 13 equipment suppliers (amongst which are WEG, Siemens and Schneider Electric). Outside ABESCO, a relatively small number (10-20) individual consultants are known to have actual experience in delivering industrial EE audits and managing EE projects; whilst a few dozen consultants working with SEBRAE and SENAI are known to have basic EE experience - again, largely focused on simple power saving interventions. As a result of a relatively timid market for industrial EE, there is limited availability of industrial EE kit in Brazil, largely due to the fact that suppliers see limited demand, meaning imports are often required, undermining the business case for EE investments.

An assessment of Brazil's EE project pipeline was based on the figures provided by ABESCO members, which report a combined revenue of R$ 1.1 bi/year, of which R$ 633M/year from ANEEL's EE levy in 2016 and the remainder primarily from equipment maintenance or sales, rather than retrofits. A closer look into the share originating from the EE levy reveals that R$ 456M were actually composed of donations of efficient fridges and light-bulbs to low-income households; R$ 144M for public lighting retrofits; and R$ 33M for simple power saving projects in the commercial and industrial sectors. Despite significant uncertainties with regards to industrial EE pipeline in the non-EE-levy share of the R$ 1.1 bi, interviewees across the Ministry of Mines and Energy (MME); ABESCO; individual ESCOs; Brazil's Industrial Confederation (CNI) and Brazil's Energy Planning Agency, indicate that <R$100M/year are dedicated to industrial EE, and a lot less for fuel efficiency. Crucially, the meager pipeline of industrial EE projects is primarily focused on relatively simple power saving interventions, rather than on the opportunities for large-scale thermal savings.

Financial instruments available for energy efficiency

At least 22 relevant financial mechanisms are available to support EE investments in Brazil, most of which government-subsidized finance for different sectors and not explicitly meant to support EE. Government backed credit lines have interests 8-15%, compared to ~15-25% commercial rates, but remain largely under-utilized and are generally perceived as unattractive due to the bureaucracy associated to obtaining such loans and the collateral requirements (~100-200%) on each loan. End-users often report preferring commercial credit lines with higher interest rates to circumvent such barriers.

Technical assistance initiatives

Six technical assistance (TA) initiatives were identified to somehow accelerate industrial EE in Brazil. Crucially, existing technical assistance initiative are relatively small, and have not managed to unlock major investments. No technical assistance initiative is directly linked to a finance mechanism.

Most significant initiatives are PROCEL's TA efforts, SENAI's Brasil + Produtivo (B+P) and the Aliança Programme. The PROCEL's TA efforts foresees the dissemination of publications, awareness raising and sparse energy audits for a range of sub-sectors including industries. SENAI's B+P incentives EE audits and face-to-face technical support to 48 industrial SMEs in metal works, clothing, shoes, furniture, food and drink industries, although only no-cost interventions were made to date. The plan is to expand the support to 400 SMEs in the years to come. The Aliança Programme subsidized EE audits in 5 large-scale industrial plants with funding from the National Confederation of Industries (CNI) and UK government grants, although only no-cost interventions delivered as a result of such audits to date. The programme is also due to expand, pending on securing further grants.

What are the barriers holding back Brazil's energy efficiency market?

Despite the existence of finance and technical assistance, several barriers limit the realization of the industrial EE opportunity - particularly across SMEs.

Table 2 summarizes the main barriers restraining the market from the perspective of end-users, the supply-chain, and financiers.

TABLE 2. Summary of barriers limiting EE development in Brazil

CATEGORIES	MAIN BARRIERS
Customer related barriers weakening the demand for EE products & services	Lack of regulatory drivers and political instability limits end-users' willingness to invest
	Lack of trust in technologies, technology suppliers and project implementers
	Lack of awareness of the commercial benefits of energy-efficiency best practice and available finance
	Lack of capacity to identify and implement opportunities
	Unwillingness to take risk re. operations and investment
Supply-chain-related barriers limiting their capacity to create a high-quality pipeline and service it	Lack of accepted contractual risk allocation framework, hindering project 'finance-ability'
	Lack of administrative and financial capacity to adequately fulfil financiers' basic requirements and make compelling investment cases, across the majority of ESCOs
	SMEs (including most ESCOs) struggle to provide the required collateral to secure loans, limiting their interest in most finance mechanisms
Financier-related barriers limiting the attractiveness of existing finance	Bureaucracy, associated with obtaining subsidized financial mechanisms
	High risk perception of financial institutions, leading to higher cost of finance

What solutions can address these barriers?

The complex array of barriers requires a spectrum of solutions that go beyond the Industrial Energy Accelerator's (Accelerator) capacity and budget.

Table 3 presents suggested solutions to key barriers, acknowledging that the Accelerator could only focus on a limited number of activities. Crucially, the Accelerator can lay the strategic groundwork for scaling up those activities with resources from GEF & others.

TABLE 3. Summary of potential area for the Industrial Energy Accelerator to focus on

BARRIER	CATEGORY	SOLUTION	PILLAR
Lack of regulatory drivers	Customer related	Revise and align regulatory drivers with government, resulting in a workplan for regulatory changes	 **1. Policy development**
		Support the creation of a dedicated EE agency to oversee/ deliver several of the solutions below	
Lack of industrial awareness & technical capacity	Customer related	Raise awareness of the industrial EE opportunity through workshops and field-days with walk-through audits in priority sectors along with industrial decision makers	 **2. Capacity building**
		Build industrial capacity around EMS	
Lack of trust in the market	Cross-cutting	Create an accreditation mechanism for supply chain, technologies and suppliers, reducing risk of finance and, if possible, linked to a financial mechanism	 **3. Pipeline**
Lack of accepted contractual framework	Cross-cutting	Develop standard contracting solutions between supply chain and industries and supply chain and banks, tackling main challenges observed and build capacity across players to utilize such solutions	 **3. Pipeline**
Lack of supply chain capacity to create and service a pipeline	Supply chain related	Develop supply chain capacity around EMS	 **2. Capacity building**
		Develop supply chain admin, legal and financial capacity to meet the requirements of financiers	 **3. Pipeline**
		Build supply chain and Suppliers' capacity around standard audit procedures, and loan business cases, leading to a low-risk bankable pipeline	
High risk perception of financial institutions	Financier-related	Build Banks' capacity around loan assessments and risk mitigation	 **4. Finance**
		Consider the creation of a risk sharing facility	
		Enhance banks' capacity to utilize project cash-flows as guarantees	
Financial bureaucracy	Financier-related	Support banks to simplify lending procedures	 **4. Finance**

TABLE 4. Summary of potential areas for the Industrial Energy Accelerator to focus on (grouped by category)

REGULATORY
Revise and align regulatory drivers with government, resulting in a workplan for regulatory changes
Support the creation of a dedicated EE agency to oversee/deliver several of the solutions below
AWARENESS & CAPACITY BUILDING
Raise awareness of the industrial EE opportunity through workshops and field-days with walk-through audits in priority sectors along with industrial decision makers
Build industry & supply chain's capacity around EMS
Develop ESCO's admin, legal and financial capacity to meet the requirements of financiers
Build ESCOs and suppliers' capacity around standard audit procedures and loan business cases
Build banks' capacity around loan assessments, lending procedures, risk mitigation, and guarantee alternatives
BUILDING TRUST & DE-RISKING
Create an accreditation mechanism for ESCOs, technologies and suppliers, reducing risk of finance and, if possible, linked to a financial mechanism
Develop standard contracting solutions between ESCOs and industries and ESCOs and banks, tackling main challenges observed and build capacity across players to utilize such solutions
Consider the creation of a risk sharing facility

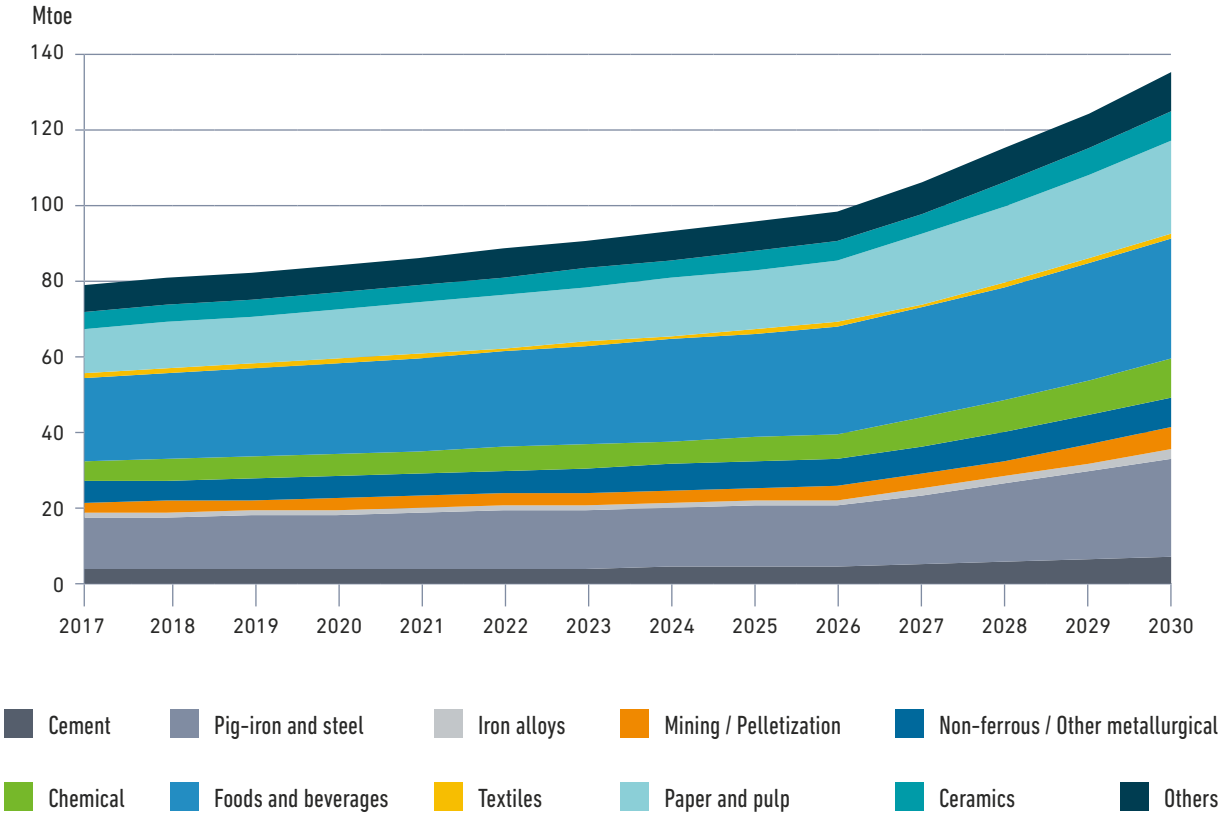
APPENDIX

Getting to know the target market: Brazil's industrial sector profile

Industry energy consumption and sub-sectors´GDP contribution

Brazil's 10-year Energy plan (PDE 2026) does not foresee substantial changes in the future participation of the industrial sector in the country's overall energy consumption up to 2026, due to the present idleness of the sector. In 2016, Brazil consumed 242 Mtoe as a whole, of which 10% was in the residential sector, 5% services (including public and commercial sector), 4% agriculture & livestock, 34% transportation, 11% energy sector and 35% industry (EPE, 2017). Based on this scenario and assuming the sector's growth rate provided in the PDE 2026, iIndustries are expected to increase energy consumption at 2.2% per year, from 84 Mtoe to 101 Mtoe in 2016 and 2026 respectively (MME, 2017).

To extend the projections of industrial energy consumption to 2030, estimates contained in Brazil's National Energy Plan to 2050 were triangulated against forecasts presented in Brazil's 10-year energy plan for 2026 - noting projections in both publications do not match, especially with regards to food and beverages and cement sub-sectors. The 2050 energy plan presents an optimistic scenario with higher overall energy consumption, due to the fact that assumptions contained in it date from years prior to Brazil's recent economic recession. The result is that, yearly energy consumption growth rates will increase from 2.2% to 8, 2% per year in the period 2017 - ´26 and 2027-´30 respectively.



Source: Data 2017 - ´26 (MME, 2017), Data 2027 - ´30 (EPE, 2016)

Figure 2. Industrial sub-sectors' energy consumption in the period 2017 - ´30 (Mtoe)

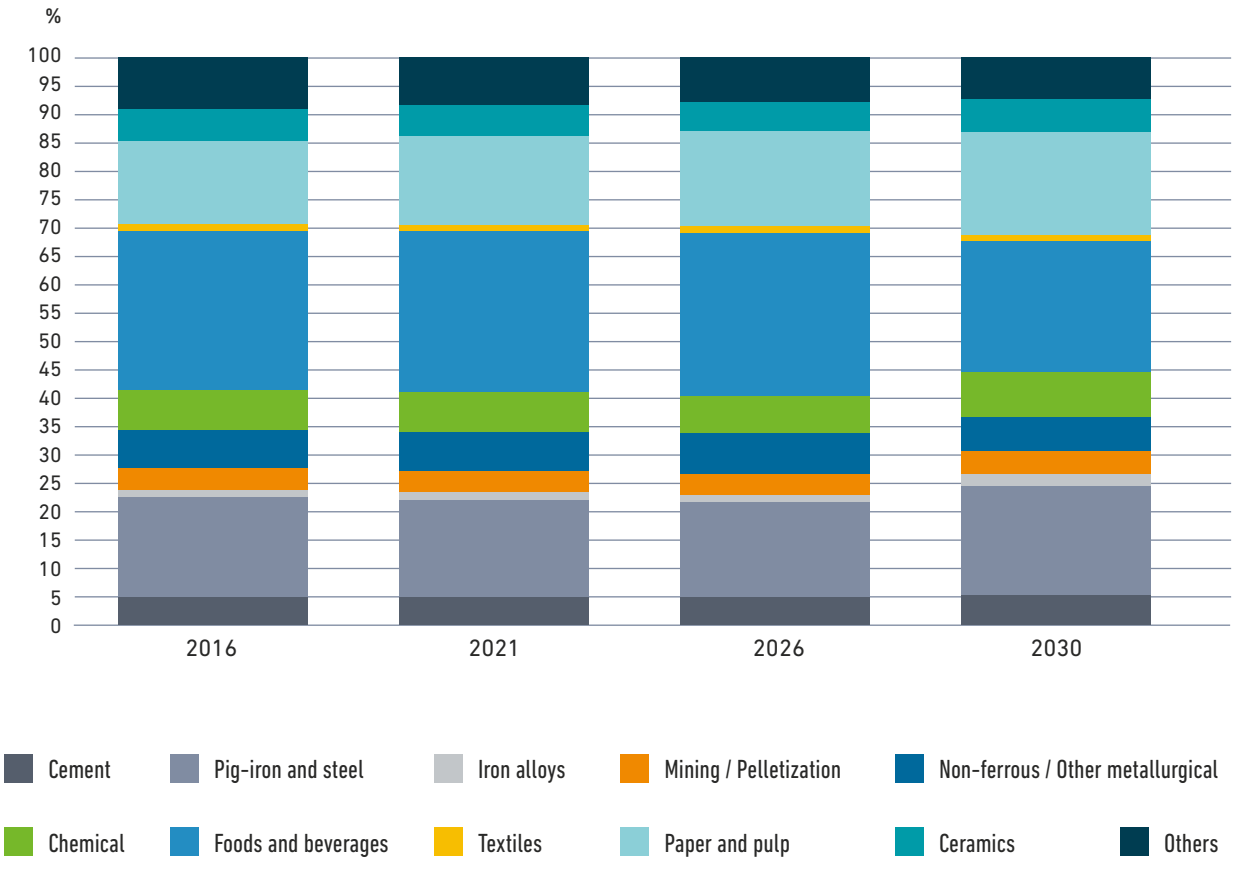
Primary export sub-sectors, such as agriculture and livestock, mining and paper and pulp, will benefit from the natural Brazilian competitiveness as well as from low exchange rate to increase their outputs at higher-than-average rates and hence increase their current shares in energy consumption. Altogether, industries will be pushed by growing exports and internal demand growth, following expectations of a rising GDP, leading to steady growth in energy demand along the time horizon (EPE, 2017).

Brazil's GDP was BRL 6.3 trillion in 2016 with industries generating approximately BRL 1.6 trillion (21%) (IBGE, 2018). The industrial GDP share is expected to be stable through to 2026 with an average growth rate of 2.6% per year (MME, 2017). To estimate industrial sub-sectors' contribution to GDP, data from (EPE, 2017) was utilized to provide a starting point for 2016, which was then extrapolated to 2026, using sub-sector growth rate assumptions for each 5-year period. The result of this assessment is presented in Figure 4 below shows relatively minor changes, with slight growths in the shares of aluminum and paper and pulp sectors whilst metallurgic, non-metallic transformation and other aggregated not-specified industries see a decreasing participation in the country's GDP.

Stratification of the industrial sector

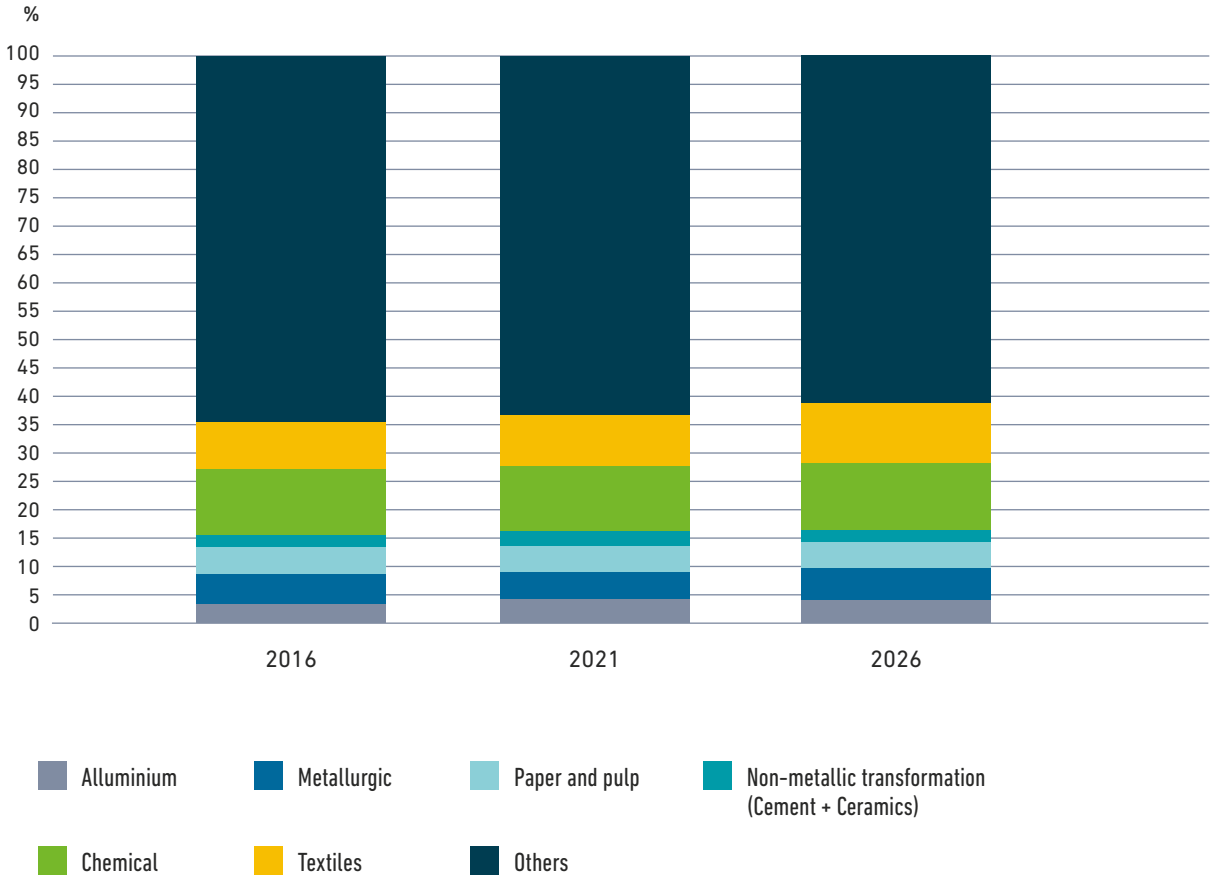
Historically, SMEs represented 99% of the industrial sector in terms of number of active companies and contributed to 47% of the industrial GDP, in the 2009 - ´11 period. Assuming the relevant industrial sectors, highlighted in Figure 3, are dominated by large companies, SMEs contributed to more than 60% of Industrial GDP in 2016.

SMEs accounted for 68% of employment in the last 10 years (SEBRAE, 2015). Industry accounted for 25% of employment rate, large companies being 32% of the market. Therefore, SMEs in the industry sector employ more than 16% of the total workforce in Brazil.



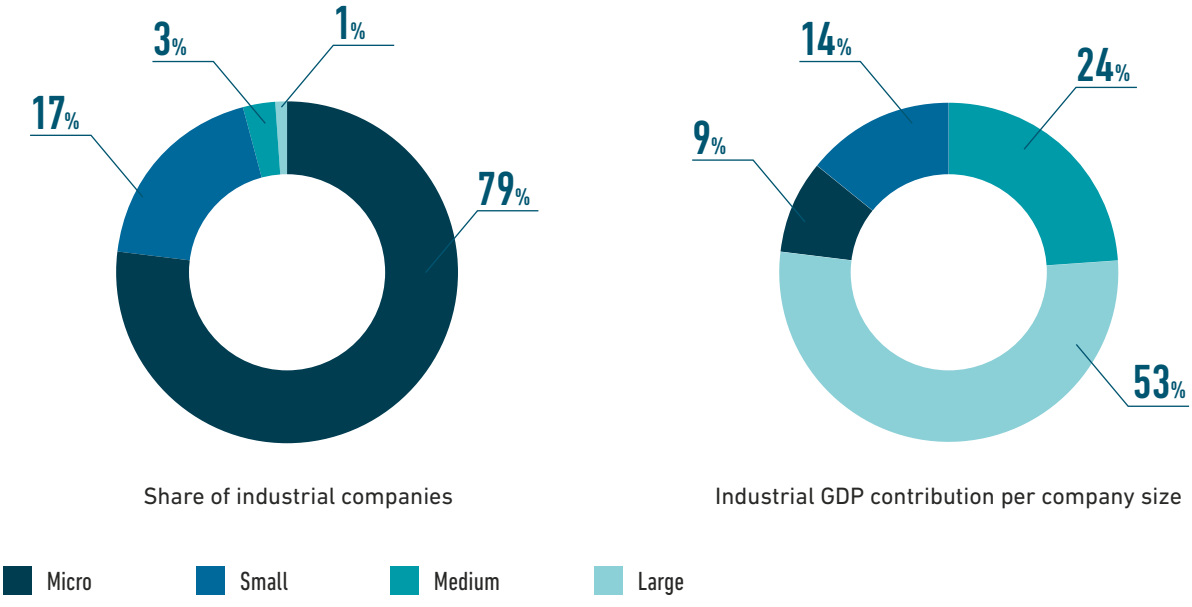
Source: Data 2017 - ´26 (MME, 2017), Data 2027 - ´30 (EPE, 2016)

Figure 3. Share of industrial energy consumption per sub-sector (%)



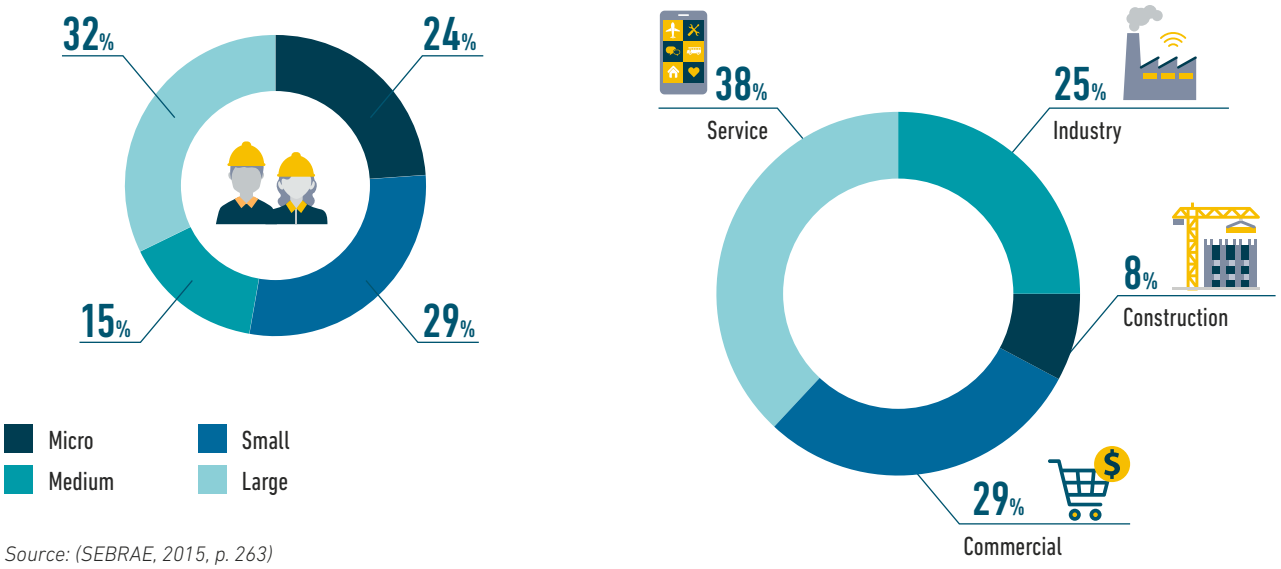
Source: (ABAL, 2017), (MME, 2017, pp. 8, 21), (IBÁ, 2017, p. 51), (MME, 2017, p. 9), (ABIQUIM, 2017, p. 14), (ABIT, 2017), (EPE, 2017, p. 22)

Figure 4. Industry sub-sectors´contribution to industry's share of GDP (%)



Source: (SEBRAE, 2014, p. 41), (SEBRAE, 2017, p. 7)

Figure 5. Share of industrial companies per size (%) and GDP contribution in 2011 (%)



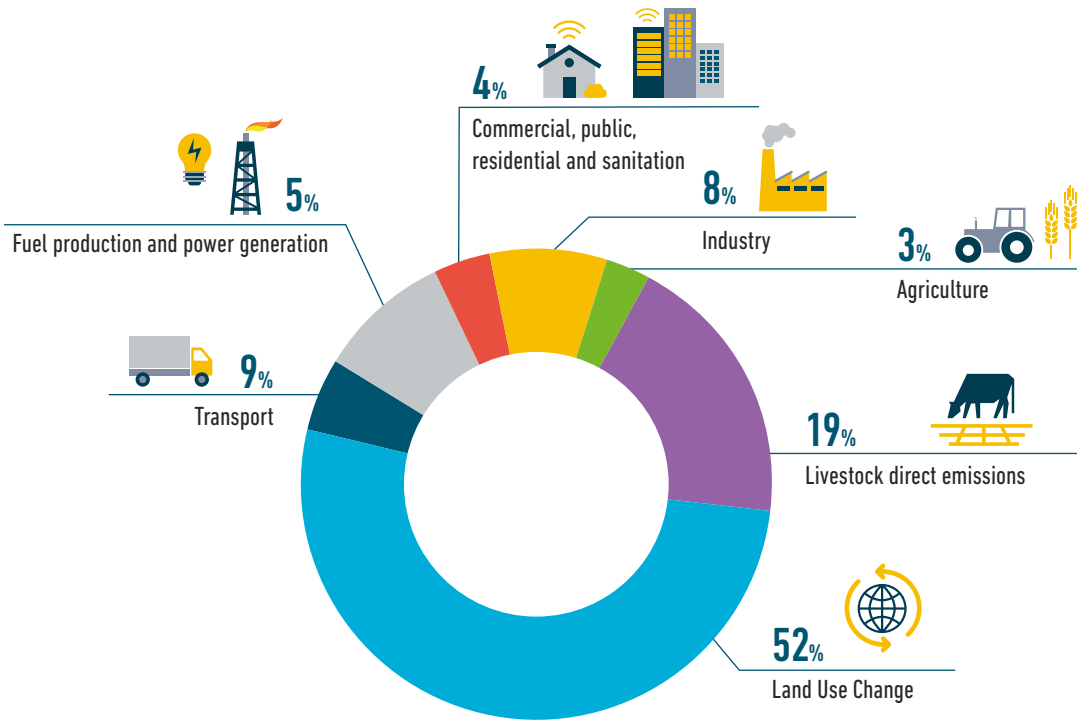
Source: (SEBRAE, 2015, p. 263)

Figure 6. Number of employees per company size and per sector in 2014

Industrial GHG emissions and mitigation options

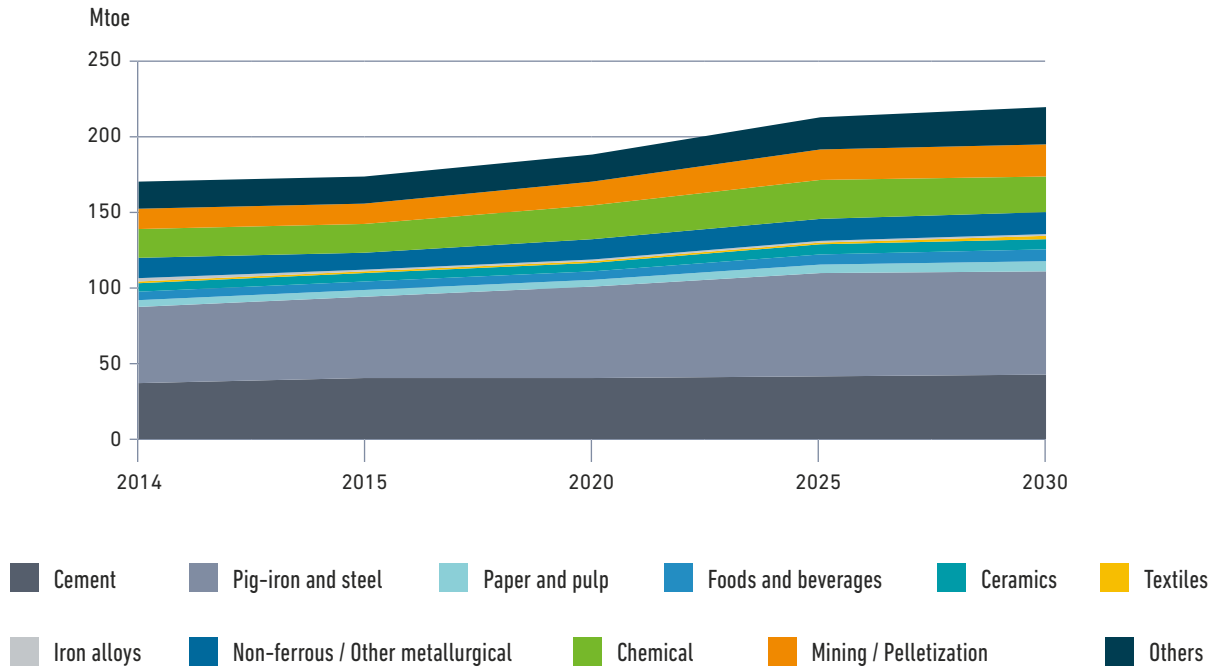
Brazil's industrial emissions in 2016 amounted to 183 $MtCO_2e$, 8% of the country's total GHG emissions as illustrated in Figure 7. Industrial GHG emissions are expected to increase at a compound 1% rate per year in the 2015 - ´30 period, reaching 208 $MtCO_2e$ in 2030, with no substantial changes amongst sub-sectors´ shares (CENTROCLIMA/COPPE/UFRJ, 2017).

Throughout the period, cement, metallurgic and chemical sectors account for more than 70% of industrial emissions. Paper, food and beverages, ceramics and other industries are expected to increase their emissions steadily, but their shares remain relatively constant.



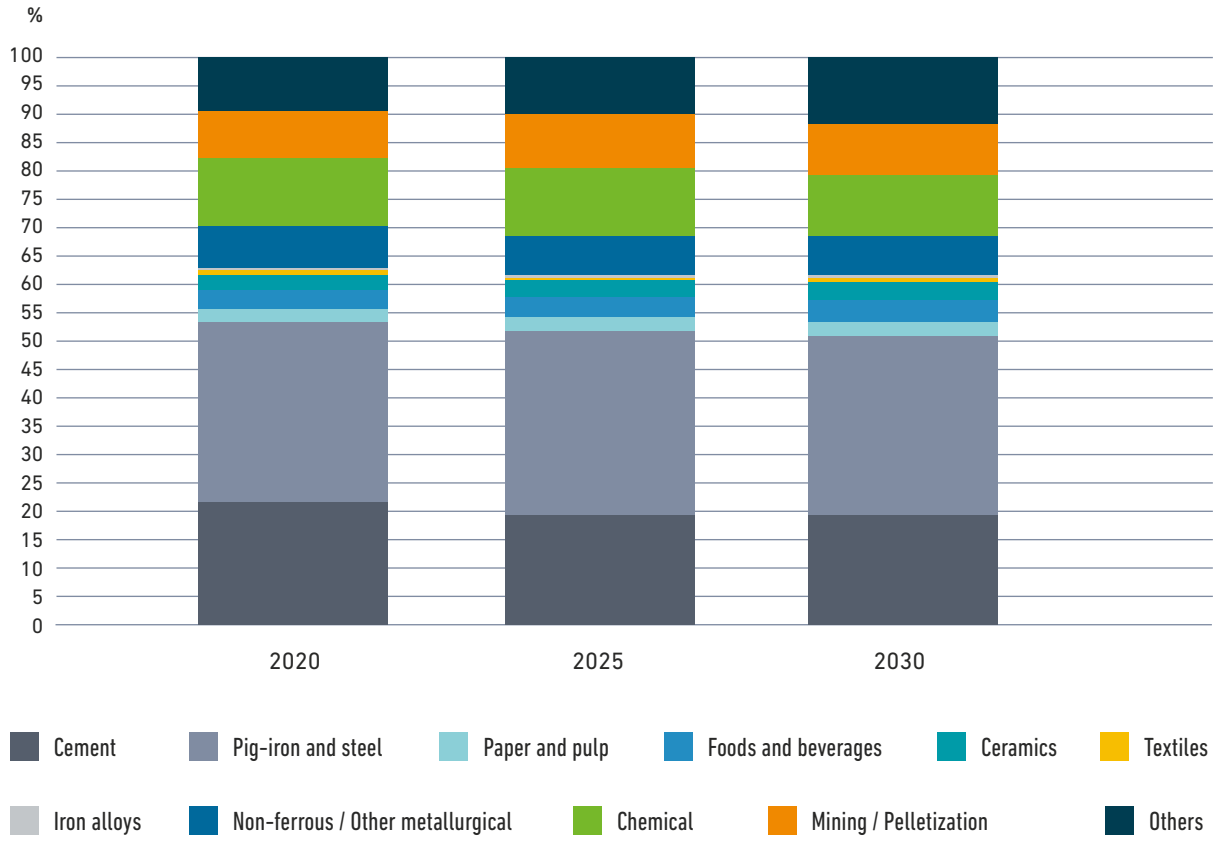
Source: (SEEG, 2018)

Figure 7. Brazilian GHG emissions per economic activity in 2016 (%)



Source: (CENTROCLIMA/COPPE/UFRJ, 2017)

Figure 8. Industrial sub-sectors´ total emissions ($MtCO_2e$)



Source: (CENTROCLIMA/COPPE/UFRJ, 2017)

Figure 9. Industrial sub-sectors´share in industrial emissions (%)

Mitigation options were investigated in (MCTI, 2017) for all economic sectors. The analysis focused on the emission intensive industries as well as other non-specified aggregated industrial sub-sectors, highlighting significant thermal efficiency opportunities, which altogether can mitigate from 13.5 to 17.2 $MtCO_2e$ up to 2030, depending on the carbon pricing in force by that period as illustrated in Table 5.

Based on a reference scenario that takes into consideration the constant goals of governmental public policies, as well as official plans for sectorial expansion, low carbon scenarios were constructed, that cover the application of best available technology (BAT) for emissions reduction, taking different carbon value levels (US$/$tCO_2e$) into account. The tax-free scenario with a null carbon value includes measures that maintain economic viability throughout their effective lifespan but are not implemented due to other barriers (e.g. technological, regulatory, behavioral, among others). The carbon tax scenario, or BC25 (in which 25 is the carbon value in US$) includes the measures for null carbon value and additional mitigation opportunities, which require internalization of the carbon pricing within the economy, in order to render them viable.

The efficient heat and steam recovery from processes is a common mitigation option in all the analyzed industries, presenting a total potential of 14.5 $MtCO_2e$ by 2030 and no carbon tax foreseen. Fuel switch is another option that would lead to additional 3.4 $MtCO_2e$ savings in a tax-free scenario. A total of 20.3 $MtCO_2e$ could be saved in the industry through economically viable practices, with no introduction of carbon pricing needed by 2030.

The introduction of a 25 US$/$tCO_2e$ carbon tax would lead to additional 3.7 $MtCO_2e$ saved through thermal EE and 3.7 $MtCO_2e$ from fuel switch options. Moreover, this scenario will allow the implementation of additional technology (otherwise economically unviable), that adds up 11.6 $MtCO_2e$ to the incremental savings, in order to reach the full potential of 39.3 $MtCO_2$ saved in the industry in 2030 (MCTI, 2017).

TABLE 5. Mitigation potential from efficiency interventions in the industry in 2030

SECTOR	MITIGATION OPTION	Tax-free mitigation potential* ($MtCO_2e$)	Carbon tax mitigation potential** ($MtCO_2e$)
Other Industries	Efficient heat and steam recovery from processes	7,5	9,1
	Blast furnaces and other process optimization	2,4	11,6
	Fuel switch	2,4	5,3
Total other industries		**12,3**	**26**
Cement	Efficient heat recovery from processes	2,9	3,5
	Fuel switch	1	1,8
	Adding slag carbonates into cement production	NA	0,8
Total cement		**3,9**	**6,1**
Chemical	Efficient heat recovery from processes	1,4	2,4
	Efficient steam recovery from processes	1	1,9
	Motor system optimization	NA	0,3
Total chemical		**2,4**	**4,6**
Steel industry	Efficient heat recovery from processes	1,7	2,2
	Injection of pulverized coal	NA	0,4
Total steel industry		**1,7**	**2,6**

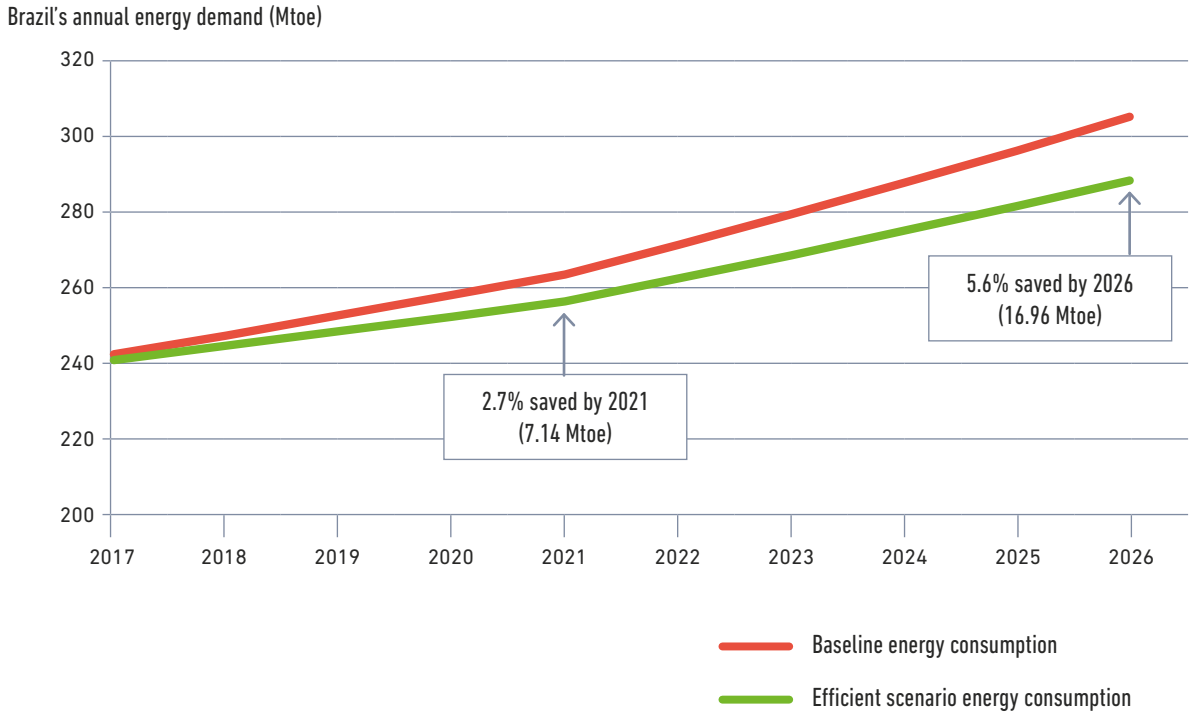
Source: (MCTI, 2017)

Energy Efficiency opportunities up to 2026

(MME, 2017) provides the data about a baseline and an efficient consumption scenario in which EE opportunities will be exploited in the 10-year period. The identified EE potential will increase from 2.7% to 5.6% of energy demand in 2021 and 2026 respectively, which means a total of 16.76 Mtoe saved in all economic sectors up to 2026.

The reference years as well as the sub-sectors' aggregated data were not sufficient to draw a yearly EE potential forecast, as illustrated in Figure 11. Therefore, to estimate the yearly savings per economic sub-sector, linear regression was used in order to complement the two scenarios, reference and efficient energy consumption levels in 2016, 2021 and 2026, provided in (MME, 2017).

Based on these calculations and splitting the country's EE potential per economic sub-sector across thermal and electricity savings, it becomes clear that the greatest opportunity lies within the transportation and industrial sectors. The former increases its EE contribution from 29% in 2017

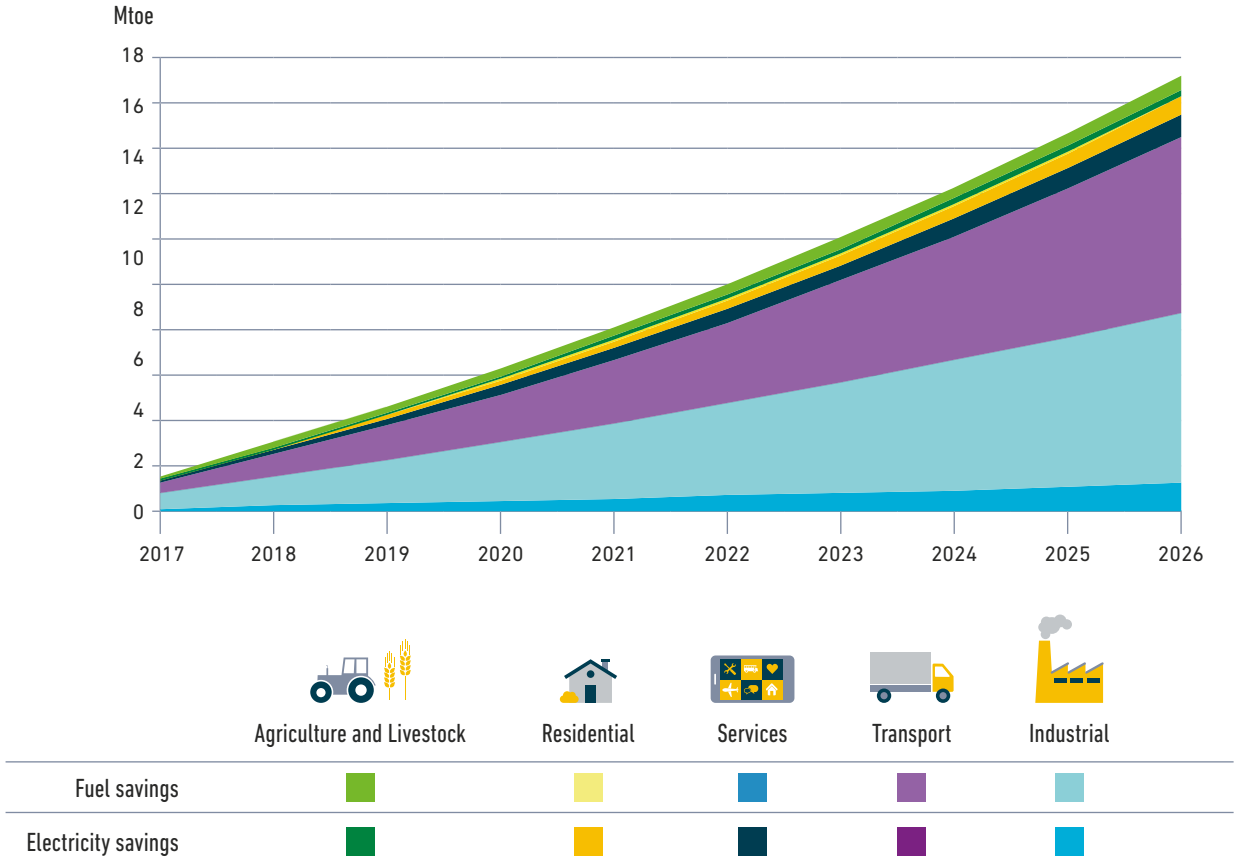


Source: (MME, 2017)

Figure 10. Brazil's Energy Efficiency potential until 2026

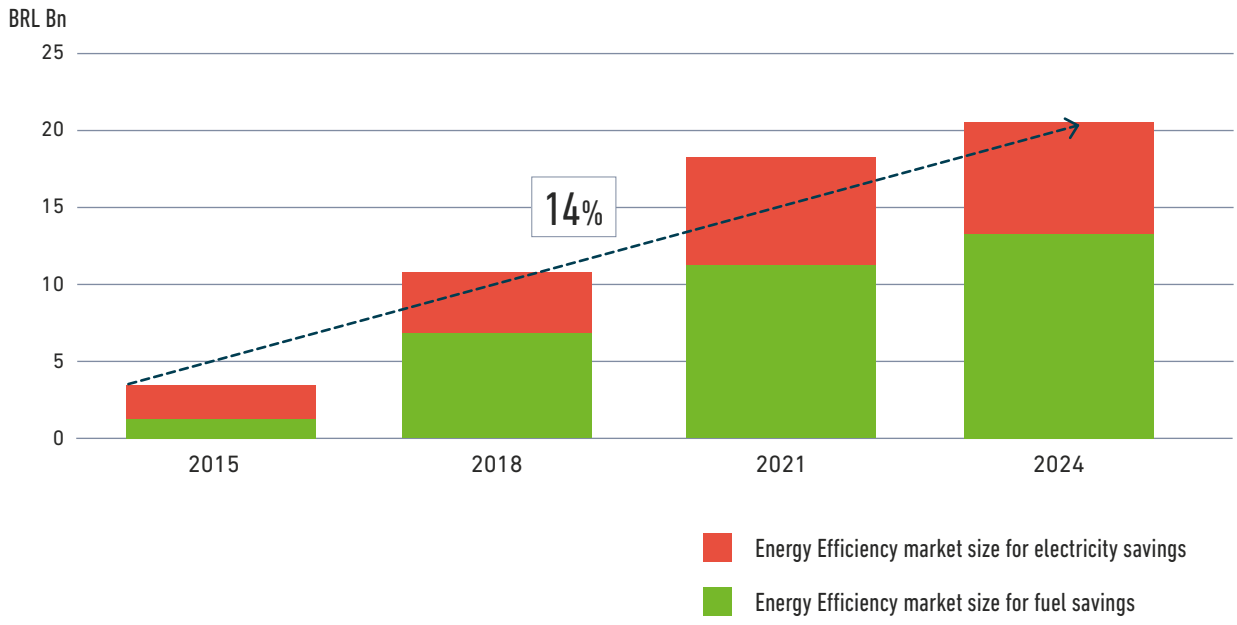
to 40% in 2026, whereas industries represent approximately 48% of EE potential in 2026. At this stage, it is not possible to say how much of this could materialize within SMEs. Total industrial EE potential from electricity and fuels is more than 7 Mtoe in the 2017- ´26 period. Fuel opportunities increase from 0.6% to 5.7% of industrial fuel consumption in 2017 and 2026 respectively. Electricity represents a lower share of industrial emissions and EE project impacts range from 0.6% to 3.8% of electricity consumption up to 2026 (MME, 2017, p. 217).

In order to provide a broader analysis, an economic assessment of EE savings opportunities has been developed. Based on the energy consumption data and EE forecasts presented in (MME, 2015) , values in BRL/ktoe were allocated for fuel and BRL/MWh for electricity to different sectors to estimate the cost savings per sector. Assuming average lifetimes of energy saving measures per sector and cost savings from avoiding new installed capacity, we estimated the total market size of energy efficiency opportunities per sector, for fuel and for electricity savings, as summarized in Figure 12. Assuming the market size will grow at an average of 14% per year, Brazil's EE market will grow from ~BRL 3.5 Bn in 2015 to ~BRL 22 Bn by 2024.



Source: (MME, 2017)

Figure 11. Total energy savings per economic sector (Mtoe)



Source: (MME, 2015)

Figure 12. Energy Efficiency market size per year (BRL Bn)

Drivers for industrial energy efficiency in Brazil

Brazil has a number of governmental plans and regulations that bear relevance to industrial EE, most are non-compulsory and lack targets. Table 6 summarizes the existing plans at federal level, cross-sector federal programmes as well as policies specifically addressed to the industrial sector.

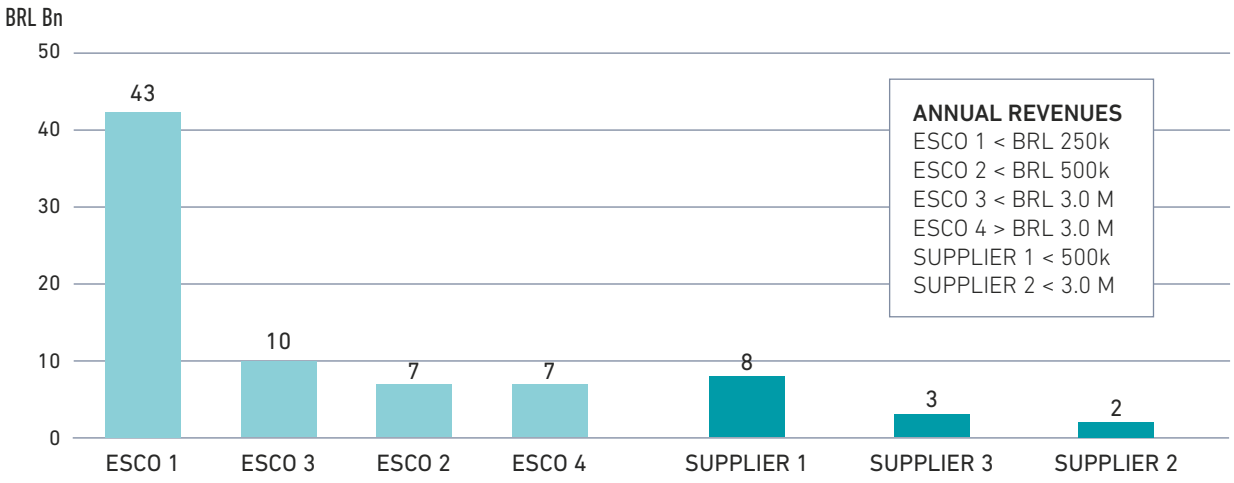
TABLE 6. Mitigation potential from efficiency interventions in the industry in 2030

FEDERAL PLANS
National Plan on Climate Change (PNMC)
National Energy Efficiency Plan
P+B Plan (Plano Brasil Mais Produtivo)
Inova Plan
CROSS-SECTOR FEDERAL PROGRAMMES
ANEEL's Energy Efficiency Programme (PEE)
Equipment Labelling Programme (PBE)
National Programme for Electricity Conservation (PROCEL)
National Programme for the Rational Use of Oil and Gas Products (CONPET)
Urban Mobility Growth Acceleration Programme (PAC 2 Mobilidade)
Federal and state government 's Sustainable Purchase Programme
CROSS-SECTOR FEDERAL REGULATION
Energy Efficiency Law
Law banning incandescent bulbs
TRANSPORT SECTOR PLANS AND REGULATION
National Plan for Logistics and Transport (PNLT)
National Urban Mobility Plan (PNMU)
Automotive Pollution Control Programme (PROCONVE)
Inovar Auto
INDUSTRIAL SECTOR PLANS AND REGULATIONS
Petrobras' operational energy efficiency programmes
BUILDING SECTOR PLANS AND REGULATIONS
Building labelling for commercial, public and residential buildings
Caixa Azul Label

Is there a supply chain for industrial energy efficiency in Brazil?

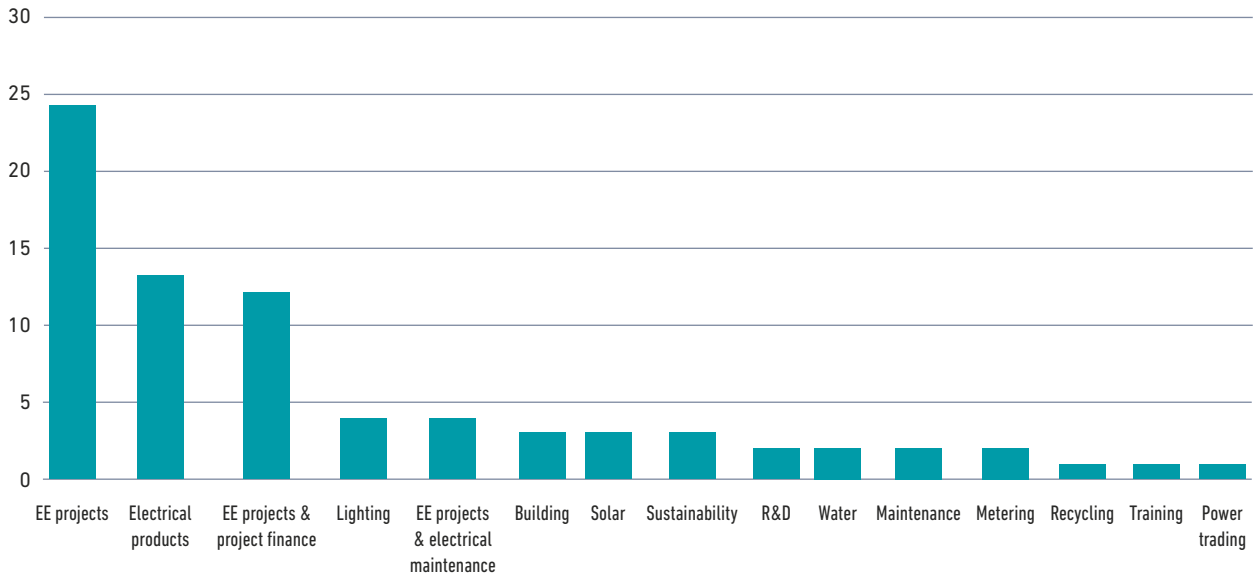
Characterization of ESCO market and pipeline

According to Carbon Trust's research, most of Brazil's ESCO association is composed of small companies providing EE and maintenance services. A significant share are just suppliers. There are about 10 'real ESCOs' in Brazil, offering off-balance sheet solutions to industrial end-users, although mostly focused on power savings. Among ABESCO's associates, 15% of ESCOs claim to offer financial solutions, less than 40% work with performance contracts and less than 40% claim to have access to EE projects in the industrial sector.



Source: (Carbon Trust, 2017)

Figure 13. Number of ESCOs per annual gross revenue category - according to ABESCO´s categories



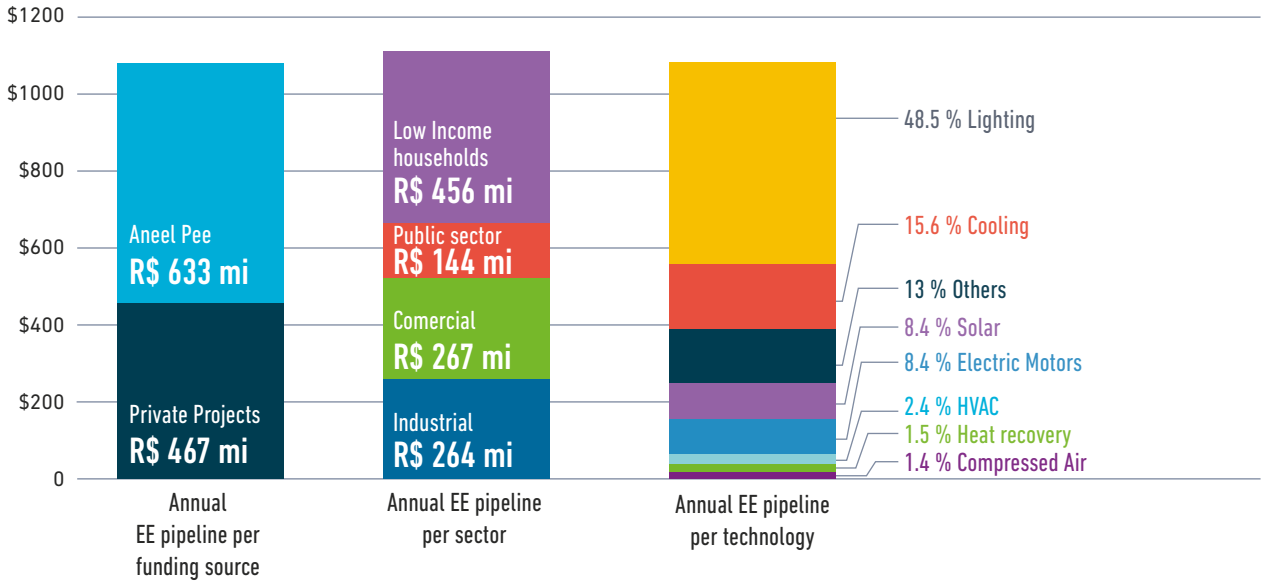
Source: (Carbon Trust, 2017)

Figure 14. Only twelve Brazilian ESCOs offer general EE project services along with financial solutions. A large number of ABESCO members are suppliers or focused on specific technology areas and do not offer finance

According to ABESCO, the existing EE pipeline in Brazil is worth BRL 1.1 Bn/year, 80% of which is related to the ANEEL's PEE and focuses on electricity projects for the residential and public sector.

Private projects are worth approximately BRL 467M per year, of which BRL 235M are addressed to the industrial sector. Considering that 5% of ANEEL's PEE is addressed to industries, the total industrial EE pipeline is BRL 264 M/year and is mainly focused on electricity projects.

In this scenario, performance contracts may not be suitable for most of ANEEL's PEE projects since these are largely simple equipment substitution in low income households and street lighting. Moreover, being electricity the main industrial area towards which funds are directed, thermal potential is still unknown and unexplored.



Source: Carbon Trust analysis based on data from ABESCO's questionnaire responses

Figure 15.EE potential market per sector and technologies profile (BRL M)

Financing mechanisms to support EE in Brazil

At least 22 relevant financial mechanisms are available for energy efficiency in Brazil, from public and private sources, covering all major sectors of economic activity (and hence energy efficiency opportunities). Finance originates from the five main sources of capital: i) Brazil's Development Bank (BNDES); (ii) federal commercial banks (Caixa Econômica Federal and Banco do Brasil); (iii) other commercial banks; (iv) electricity distribution utilities operating under ANEEL's PEE; and (v) other international development banks, e.g. Inter-American Development Bank (IDB).

These credit lines disburse BRL billions each year but the precise figure directed towards actual energy efficiency is not clear, as: (i) most finance mechanisms are not targeting energy efficiency, but general 'modernization' of sectors or end-user groups, which includes services, investments in increased production capacity, new (not necessarily efficient) equipment, and renewable energy, e.g. BNDES' FINAME credit line, which disburses R$ 23bn/year; and (ii) financial institutions (especially private ones) do not publish their independent disbursements for energy efficiency.

Despite the availability of approximately R$ 10 billion in finance, which can in theory fund energy efficiency projects, Table 7 provides evidence that financial institutions have limited focus on capturing the energy efficiency opportunity highlighted in Figure 11 and seldom account for energy efficiency finance achievements. The barriers limiting energy efficiency finance from demand and supply sides are explored in the following section.

TABLE 7. At least 22 financial products were identified as being available to support energy efficiency investments in Brazil

Subsidized loans
Credit enhancement mechanism
Market rate loan
Regulatory obligation scheme

	Credit line/ program name	Total budget available (R$ million)	Yearly disbursement (R$ million/yr)	Solely energy efficiency?	Route to recipient
BNDES	**FINEM**				
	Energy Efficiency Credit Line	Undisclosed	~ R$ 200 (R$640 since 2015)	YES	Direct (>R$20M) or via commercial banks (>R$5M<R$20M
	Industrial Productive Capacity		~R$ 200	NO (equipment modernization	
	FUNDO CLIMA				
	Efficient transport	R$20	Not available	YES	Via commercial banks
	Efficient machinery	R$20			
	OTHER				
	Cartão BNDES	Undisclosed	R$5,636	No (any form of investment for SMEs)	Via commercial banks
	BNDES Automático		R$7,436		
	Fundo de Garantia para Investimentos (FGI)	Undisclosed	Undisclosed	NO	Via commercial banks
	FINAME				
	Industrial	Undisclosed	R$ 1,314	NO	Via commercial banks
	Agricultural		R$ 6,982	NO	
	Infrastructure		R$ 1,128	NO	
	Transport		R$ 6,760	NO	
	Other		R$ 1,460	NO	

Target clients/ sectors	Loan size range	Payback time limit (years)	Approx. Interest rate (per year)
ESCOs, end-users, and utilities	>R$10M with no upper limit	**Public lighting:** 15 y **Other projects:** 10 y	>R$20M for companies: 9.1-13.5% >R$20M for local governments: 9.7% <R$20M: 9.1%-15% (depending on commercial banks' risk perception)
Industry	>R$10M – <R$ 100M	6	5.1% -15% (depending on commercial banks' risk perception)
Transport	>R$1M – <R$10M	20	2.5 - 9.5%
Industrial and commercial		8	
SMEs in all sectors	<R$1M	4	10.82%
	>R$500k – <R$5M	Undefined	5.1% -15% (depending on commercial banks' risk perception)
All sectors (companies with turnover <R$90M)	<R$10M	Undefined	Cost depends on: (i) value of guarantee, (ii) percentage of loan guaranteed, (iii) length of tenor.
Industrial	>R$1M – <R$10M	**Public transport vehicles:** 6 - 9 y **Transformation industry:** 10 y **Equipment acquisition in other sector:** 3 y	3.5%-15% (depending on commercial banks' risk perception)
Agricultural			
Public sector or private initiatives			
Public sector or private initiatives			
Several			

	Credit line/ program name	Total budget available (R$ million)	Yearly disbursement (R$ million/yr)	Solely energy efficiency?	Route to recipient
FINEP & BNDES	Inova Sustentabilidade	R$ 2,000	Undisclosed	NO	Direct (>R$20M) or via commercial banks
Desenvolve SP	Linha verde	Undisclosed	R$ 30	NO	Direct
Caixa Econômica Federal	Crédito Verde	Undisclosed	Undisclosed	NO	Direct
	Proger Urbano Empresarial	Undisclosed	Undisclosed	No (any form of investment for SME development)	
Banco do Brasil	BB Crédito Empresa	Undisclosed	Undisclosed	No (any form of investment for SME development)	Direct
	FCO Empresarial	R$ 9,700	Undisclosed		
	Proger Urbano Empresarial	Undisclosed	Undisclosed		
Commercial Banks (including Itaú, Bradesco, Santander)	Working Capital Credit lines	Undisclosed	Undisclosed	NO	Direct
Electricity Distribution Utilities	ANEEL's Energy Efficiency Program	R$ 630	R$ 630	YES	Direct to end-users or ESCOs
InterAmerican Development Bank	Energy Efficiency Guarantee Mechanism – **no longer active**	R$50	<R$ 20	YES	Via commercial banks

Subsidized loans
Credit enhancement mechanism
Market rate loan
Regulatory obligation scheme

Target clients/ sectors	Loan size range	Payback time limit (years)	Approx. Interest rate (per year)
Industrial and sanitation EE	>R$1M <R$10M	20 y	7%-15% (depending on commercial banks' risk perception in case of indirect operations)
Multiple sectors	>R$ 500k <R$ 3M	10 y	12%-13%
Housing and transport	>R$100k <R$5M	4.5 y	1.3% -
SMEs in any sector with revenues below certain thresholds	>R$400k <R$1M	6y	9-15% (depending on Caixa's risk perception)
SMEs in any sector with revenues below certain thresholds (only in Centre-West States in case of FCO Empresarial)	<R$1M	5y	9-15% (depending on BB's risk perception)
	>R$1k– <R$100k	10-20y	
	>R$400k <R$1M	6y	
All	No limit	Usually <5y	17 - 25%
All sectors within each utilities' concession area	<R$ 20M	Usually <5y	not applicable
ESCOs and building constructors	Undisclosed	7	not applicable

Source: Carbon Trust analysis; BNDES statistics contained in: FINAME disbursements; BNDES Statistics; BNDES total disbursements; FCO Credit line budget; FINEP & BNDES Inova Programmes. Notes: All subsidized credit lines under BNDES and FINEP are limited to 70%-90% of full project values, requiring borrowers to find alternative sources of finance to fill in the remaining gap. BNDES' indirect disbursements (R$ 48 billion in 2016) are chiefly made by: Bradesco (16%); Banco do Brasil (14%); Santander (11%); and Itaú (9%). It's worth noting that BNDES' total disbursements have decreased severely since 2013, moving from R$ 190 billion in 2013 to R$ 88 billion in 2016.

Existing technical assistance and awareness raising initiatives

There are few technical assistance initiatives that work in tandem with the financial mechanisms outlined above to encourage energy efficiency investments in Brazil. The exact amount of technical assistance available to catalyse the market for energy efficiency in Brazil is unknown since the initiatives are decentralized, often combined with broader programmes/budgets and there is limited or no data available on their expenditures and performance. All major technical assistance initiatives identified to promote the energy efficiency market in Brazil are listed in Table 8, including basic information on their focus, delivery agents and key activities.

TABLE 8. Multiple initiatives provide awareness raising and/or technical assistance on energy efficiency

NAME OF INITIATIVE	PLANO BRASIL MAIS PRODUTIVO
FOCUS MUNICIPALITY AND STATE	Country- wide
TARGET SECTOR/ AUDIENCE	Industrial SMEs
IMPLEMENTING PARTNERS	SENAI & SEBRAE
FUNDER	MDIC, ABDI, PROCEL
KEY ACTIVITIES	Advice package and face-to-face technical support for industrial SME to render their activities more efficient. A particular emphasis is given to SMEs in metal works, clothing, shoes, furniture, food and drink industries.

NAME OF INITIATIVE	PROCEL SUB- PROGRAMMES
FOCUS MUNICIPALITY AND STATE	Country- wide
TARGET SECTOR/ AUDIENCE	Buildings, industry, commerce, public sector, public lighting
IMPLEMENTING PARTNERS	PROCEL
FUNDER	PROCEL
KEY ACTIVITIES	PROCEL's sub-programmes for industries, commerce, buildings, public sector and public lighting have delivered a range of publications on EE advice, funded energy audits in multiple sectors, and directly financed the enhancement of EE specialist laboratories in a range of universities.

Source: Carbon Trust research, adapted from: (PROCEL, 2017); (MDIC, 2017); (SENAI, 2017) and interview with representative of CNI.

NAME OF INITIATIVE	CNI & SENAI 'SOFT SUPPORT'
FOCUS MUNICIPALITY AND STATE	Country- wide
TARGET SECTOR/ AUDIENCE	Industries
IMPLEMENTING PARTNERS	SENAI
FUNDER	CNI and SEBRAE
KEY ACTIVITIES	CNI and SENAI have jointly published a range of technical reports on EE opportunities, delivered courses and workshops to support investments on EE in multiple sectors.
	To some extent (figures unknown) it has also contributed with face-to-face support for specific industries over the past decades.

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