Biomethane in the State of São Paulo: **Potential and Measures to Promote Production**

RESULTS OF THE STUDY CONDUCTED BETWEEN JANUARY AND AUGUST 2024 AND PRESENTED IN THE EXECUTIVE SUMMARY AND TECHNICAL REPORT PUBLISHED IN JUNE 2025

NOVEMBER 2025

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POTENTIAL BIOMETHANE SUPPLY

6,4 mi Nm³/dia
2,3 bi Nm³/ano - Fonte: FIESP,2024
181 plantas
Aterros sanitários e usinas sucroenergéticas (vinhaça e torta de filtro).

8,2 mi Nm³/dia
3 bi Nm³/ano - Fonte: i17, 2021 (BEP/UK)*

9,8 mi Nm³/dia
3,6 bi Nm³/ano - Fonte: SEMIL/SP, 2023
Resíduos do lodo de estações de tratamento de esgoto; Vinhaça do setor sucroenergético; Gás dos aterros sanitários

23,6 mi Nm³/dia
8,6 bi Nm³/ano - Fonte: Coelho et al, 2020 (USP)
Sucroenergético; vinhaça, torta de filtro e palha; FORSU - biodigestor; Esgoto (cenário ideal); Dejeto animal; Abatedouros; Cervejarias.

36,4 mi Nm³/dia
13,3 bi Nm³/ano - Fonte: ABiogás, 2020
Palha da cana; Bagaço de cana; Vinhaça; Torta de filtro; RSU – Aterro Sanitário; Esgoto; Laticínios; Abatedouros; Dejetos de animais; Soja; Milho; Mandioca; Cevada.

42,5 mi Nm³/dia
GEF Biogás Brasil
15,5 bi Nm³/ano

*Sucroenergético: vinhaça, torta de filtro; FORSU - Biodigestor; Esgoto; Avicultura de postura; Suinocultura em terminação; Bovinocultura de leite; Abatedouro de suínos, aves e bovinos; Laticínios.

POTENTIAL DEMAND FOR BIOMETHANE

3,4 mi Nm³/dia
1,2 bi Nm³/ano
Potencial demanda de curto prazo considerando a demanda de biometano calculada no cenário acelerado e com mandato, de acordo com os incentivos propostos.

17,9 mi Nm³/dia
6,5 bi Nm³/ano
Demanda potencial de médio prazo, considerando o ineteresse do setor industrial em consumir biometano, com base no questionário realizado. Demanda potencial de 60% no transporte pesados, considerado apenas caminhões pesados e semipesados.

58,5 mi Nm³/dia
21,4 bi Nm³/ano
Consumo de gás natural, óleo diesel, óleo combustível, GLP e coque de petróleo no setor industrial. Consumo de gasolina, gás natural e diesel no setor de transporte.

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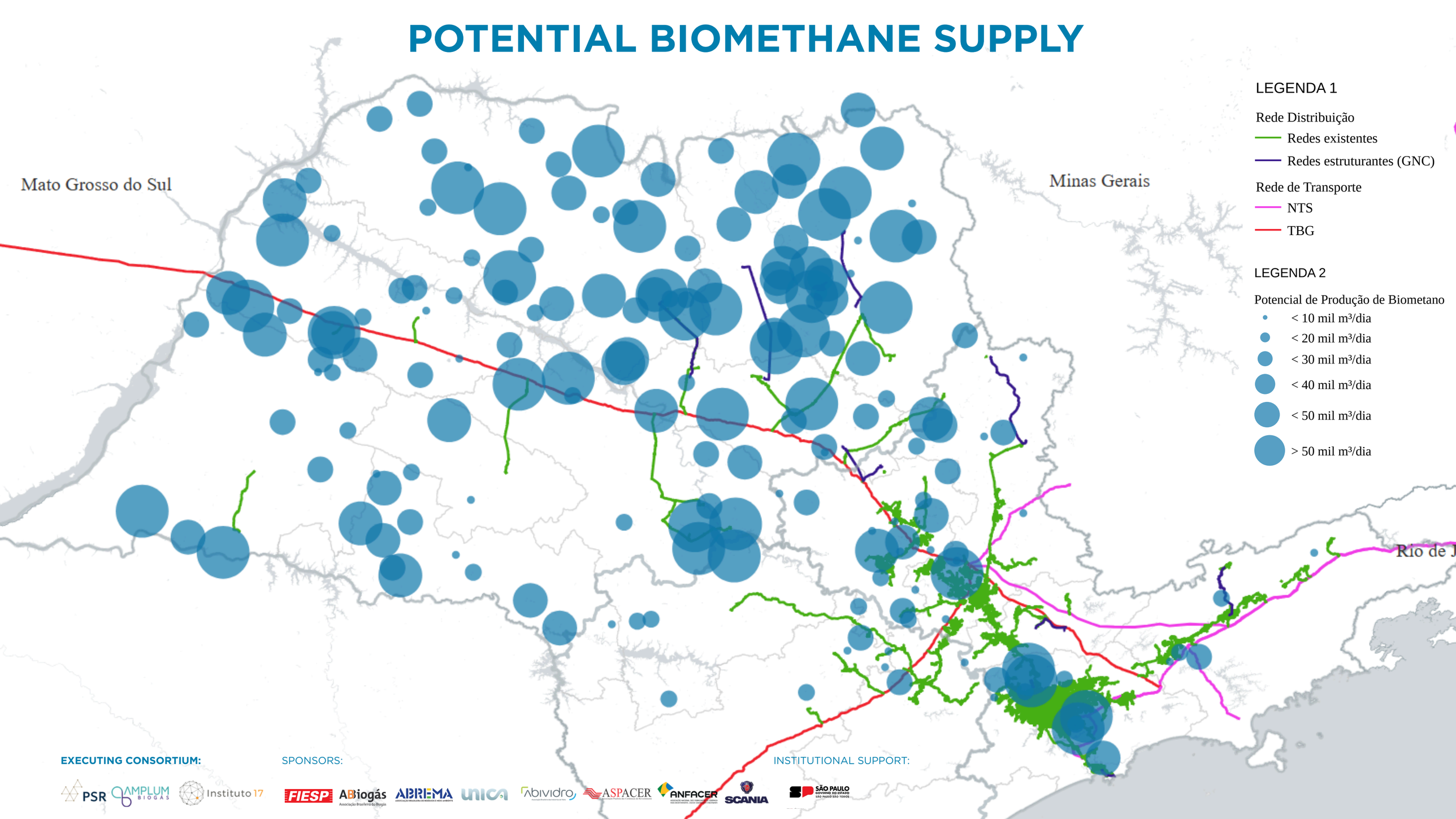
POTENTIAL BIOMETHANE SUPPLY



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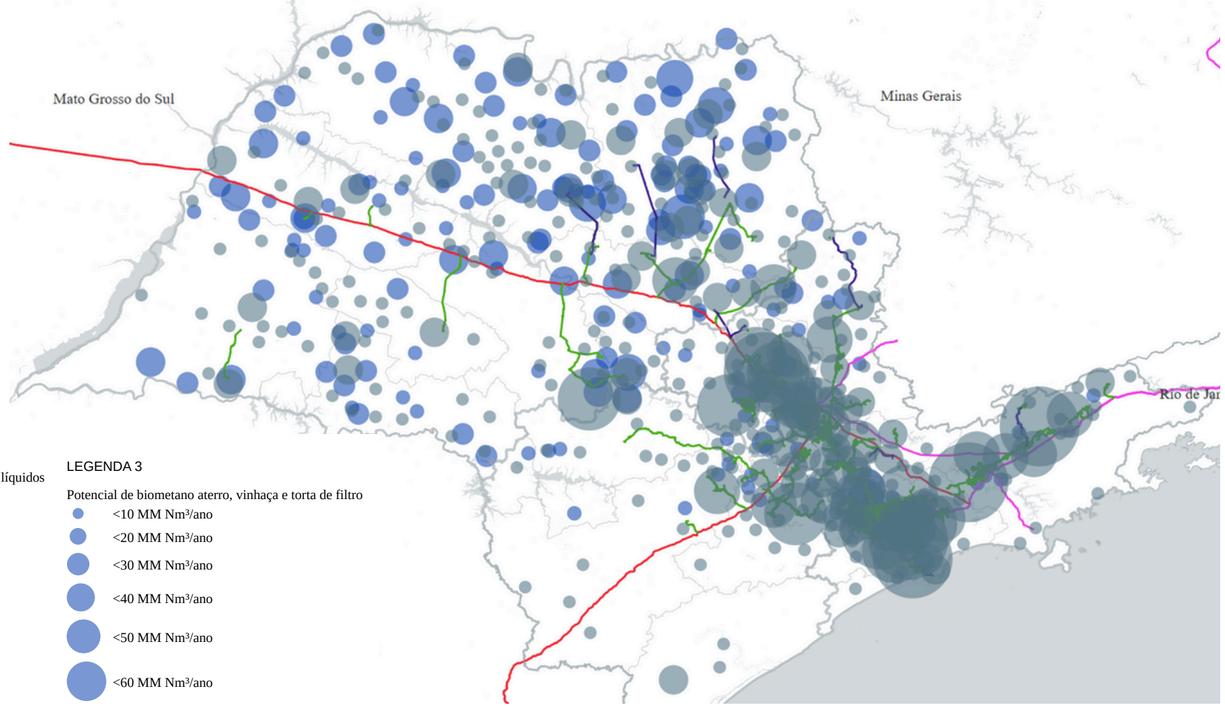


LEGENDA 1

Rede de Distribuição
- Redes existentes
- Redes estruturantes (GNC)

Rede de Transporte
- NTS
- TBG

LEGENDA 2

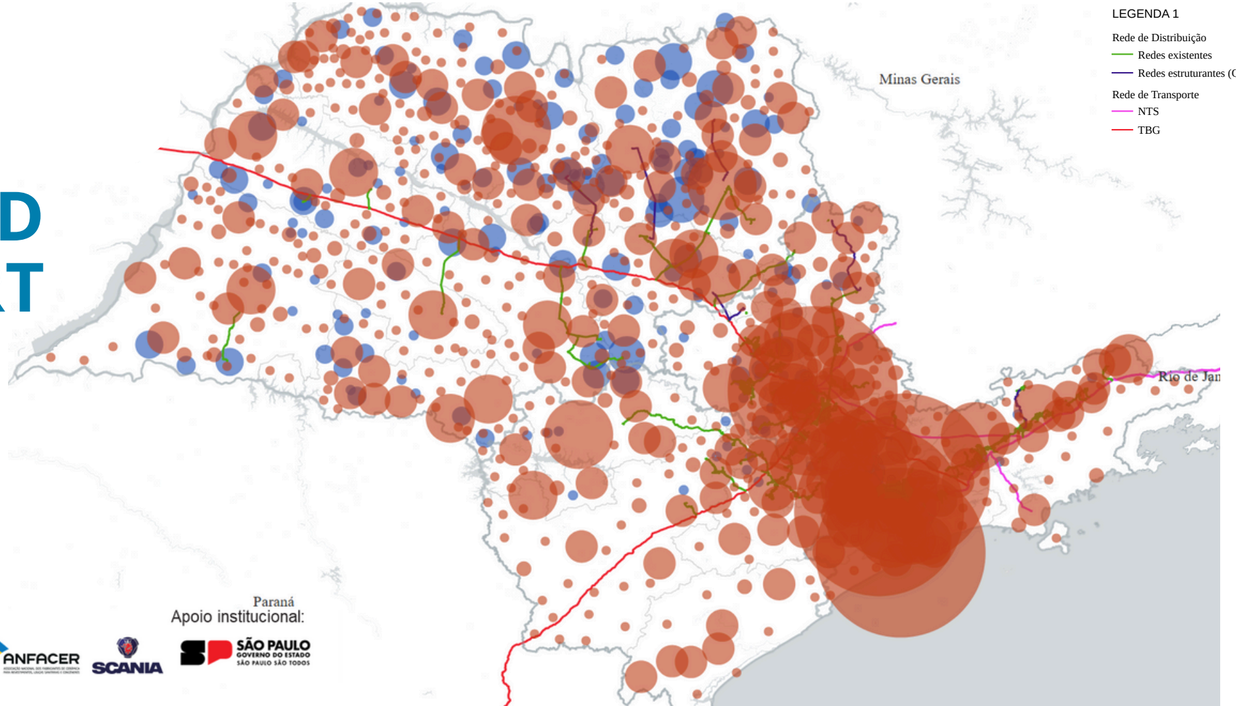
Consumo de GN e combustíveis líquidos
- < 10 MM Nm³/ano
- < 30 MM Nm³/ano
- < 90 MM Nm³/ano
- < 200 MM Nm³/ano
- < 340 MM Nm³/ano

LEGENDA 3

Potencial de biometano aterro, vinhaça e torta de filtro
- <10 MM Nm³/ano
- <20 MM Nm³/ano
- <30 MM Nm³/ano
- <40 MM Nm³/ano
- <50 MM Nm³/ano
- <60 MM Nm³/ano

POTENTIAL DEMAND IN INDUSTRY

POTENTIAL DEMAND IN HEAVY TRANSPORT



LEGENDA 1

Rede de Distribuição
- Redes existentes
- Redes estruturantes (GNC)

Rede de Transporte
- NTS
- TBG

LEGENDA 3

Consumo de diesel no transporte
- <5 MM Nm³/ano
- <10 MM Nm³/ano
- <50 MM Nm³/ano
- <100 MM Nm³/ano
- <200 MM Nm³/ano
- < 1.200 MM Nm³/ano

LEGENDA 2

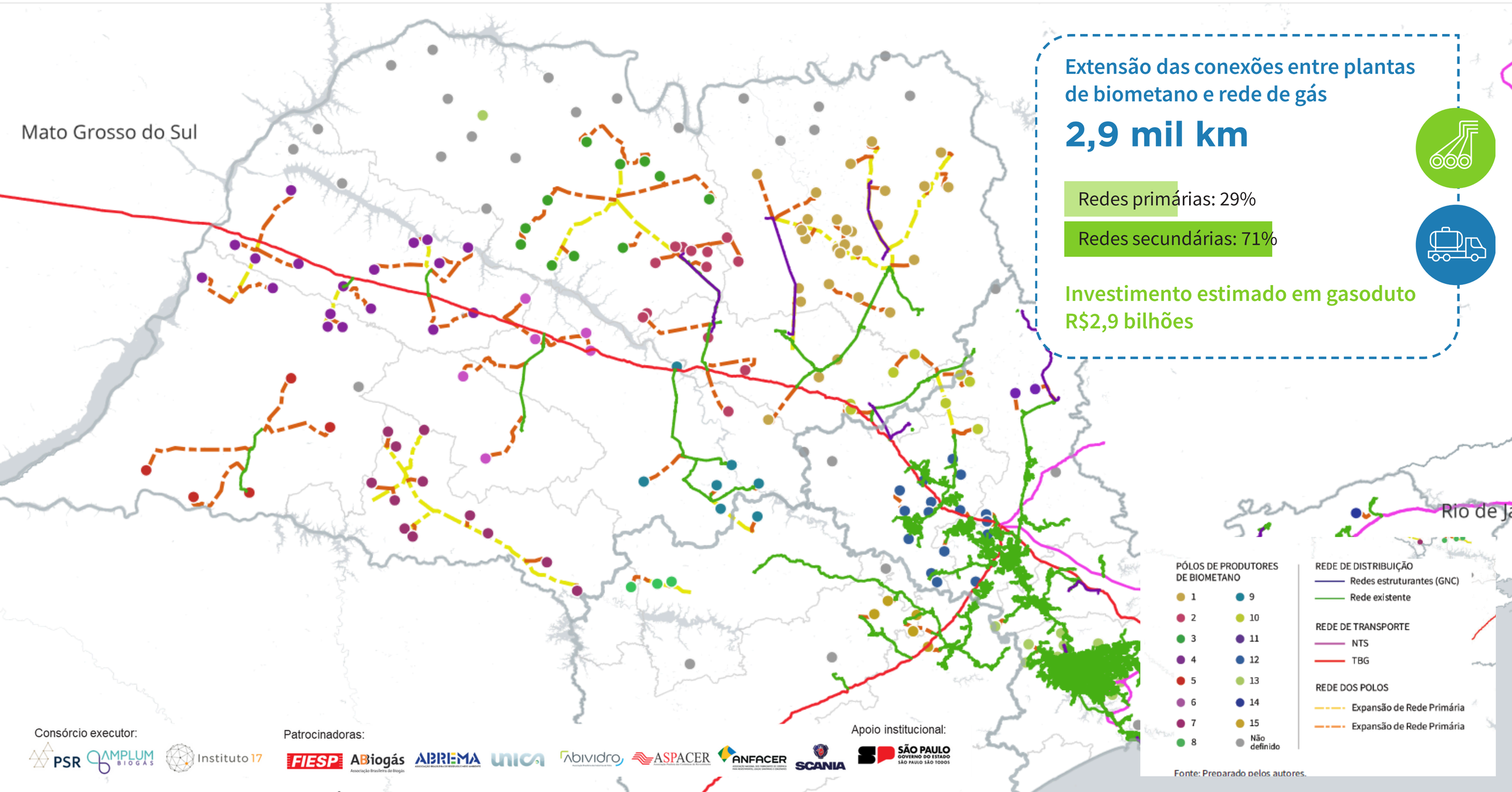
Potencial de biometano de aterro, vinhaça e torta de filtro
- <10 MM Nm³/ano
- <20 MM Nm³/ano
- <30 MM Nm³/ano
- <40 MM Nm³/ano
- <50 MM Nm³/ano
- <60 MM Nm³/ano

Consórcio executor:

Patrocinadoras:

Apoio institucional:

POTENTIAL BIOMETHANE SUPPLY HUBS



Consórcio executor:

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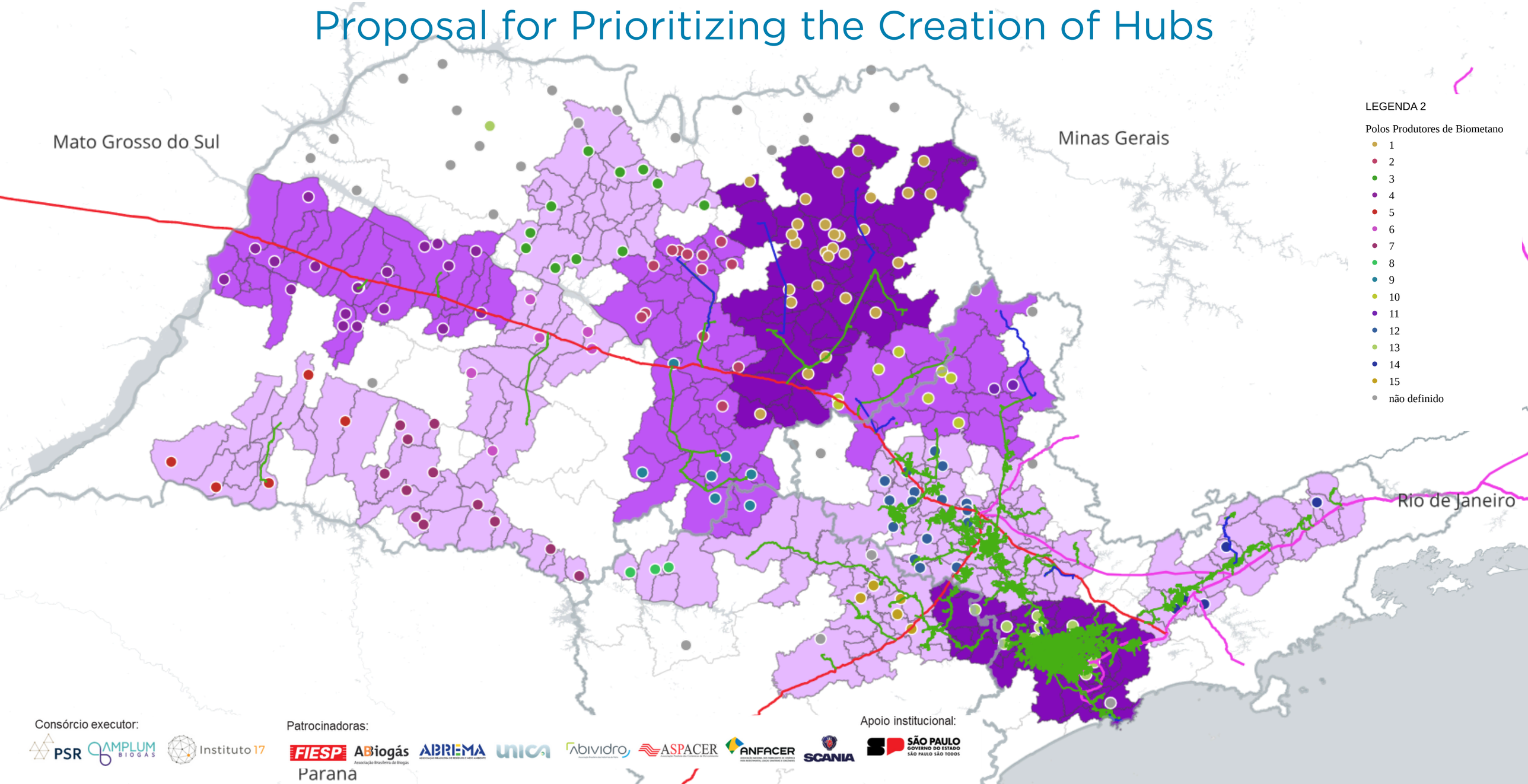
Apoio institucional:

POTENTIAL BIOMETHANE SUPPLY HUBS:

Proposal for Prioritizing the Creation of Hubs



Consórcio executor:

Patrocinadoras:

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LEVELIZED COST OF BIOMETHANE (LCOB)

For several scales, substrates an logistics

SELF-PRODUCTION SCENARIO

NO SALES TAX AND
NO LOGISTICS COSTS

R$ 1,70 a 2,60/m³

Equivalent to:
US$ 9,10 a US$ 13,70/MMBTU

COMMERCIALISATION SCENARIO PRIOR TO LOGISTICS

WITH SALES TAXES AND
NO LOGISTICS COSTS

R$ 2,20 a 3,30/m³

Equivalent to:
US$ 11,60 a US$ 17,60/MMBTU

COMMERCIALISATION SCENARIO WITH MULTIPLE MODES OF LOGISTICS

INCLUDING SALES TAX AND
LOGISTICS COSTS

R$ 2,80 a 5,30/m³

Equivalent to:
US$ 15,10 a US$ 28,30/MMBTU

COMPARING TO REFERENCES:

South and Central America
US$15 and US$27/million BTU
(IEA, 2020 - 2018 values)

World
US$ 5,00 a US$ 29/MMBTU
(IEA, 2020 - 2018 values)

Europe
US$ 15,82 a US$ 28,49/MMBTU
(Wouters, 2020)

They don't take logistics into account.

- LCOB analysis considers ICMS tax credits.
- Value considered for conversion to dollars: R$5.00 - US$1.00
- Conversion: 26.8081 m³/MMBTU (ANP, 2022)
- The scale of biomethane plants varies from 15,000 to 90,000 m³/day.
- Different business structures that decide to invest in the business may define different cost structures for the project and different expected rates of return. In other words, these values should be used as a reference for planning state public policies, but any investment decision must undergo a detailed analysis of the project's reality and the context in which it is inserted.

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HOW TO REALIZE THIS POTENTIAL

- The development of the biomethane market still presents a series of **challenges that interact and create a complex situation**:
  - Limited competitiveness in the short term (price of biomethane vs. competing energy sources)
  - Territorial mismatch between potential supply and demand (logistical problem)
  - Demand and remuneration for environmental attributes

- **Actions to overcome** these challenges must have clear **criteria**:
  - Impact on the transformation of the biomethane market
  - Implementation timeline and benefit capture.
  - Complexity of implementing the measure
  - Market efficiency

- **The role of the government** is fundamental in **defining the appropriate** set of incentives and **well-articulated public policies** to mitigate initial barriers and develop long-term objectives.

PRIORITY MEASURES SUGGESTED FOR THE STATE GOVERNMENT TO ENCOURAGE BIOMETHANE IN THE SHORT TERM

Offer of biomethane at the lowest price

- Coordination for the valuation of environmental attributes (certificates/GHG Protocol);
- ICMS reduction on biomethane;

Investment in infrastructure for biomethane distribution:

- **Hubs** planning;
- Strengthening the role of biomethane in concession renewal criteria;
- Regulatory improvement.

Stimulating gas demand in heavy transport:

- Corridor Planning;
- Reduction of vehicle tax (IPVA) and sales tax (ICMS) on gas-powered trucks and equipment for refueling gas-powered vehicles.

Cross-sections measures:

- Matchmaking platform;
- Strategies for capacity building, R&D, and incentives for the equipment industry.

Prioritization of measures throughout the study

65 MEASURES → **12** MEASURES → **9** MEASURES

SCENARIOS FOR ANALYZING THE IMPACT OF INCENTIVE MEASURES ON THE LEVELIZED COST OF BIOMETHANE (LCOB)
Comparing to a basis scenario

Pessimistic Scenario:
LCOB Increase
Between 14% and 35%

Optimistic Scenario:
LCOB Reduction
Between 18% and 55%

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CURRENT STATUS

PRIORITY MEASURES SUGGESTED FOR THE STATE GOVERNMENT TO ENCOURAGE BIOMETHANE IN THE SHORT TERM

Offer of biomethane at the lowest price

- Coordination for the valuation of environmental attributes (certificates/GHG Protocol); **-** ***Under implementation***
- ICMS reduction on biomethane - ***The tax reduction has been extended***

Investment in infrastructure for biomethane distribution:

- Hubs planning - ***Under study***
- Strengthening the role of biomethane in concession renewal criteria - ***Under implementation***
- Regulatory improvement - ***Under implementation***

Stimulating gas demand in heavy transport:

- Corridor Planning - ***Under study***
- Reduction of vehicle tax (IPVA) and sales tax (ICMS) on gas-powered trucks and equipment for refueling gas-powered vehicles - ***The IPVA reduction has been approved***

Cross-sections measures:

- Matchmaking platform - ***Under implementation***
- Strategies for capacity building, R&D, and incentives for the equipment industry - ***Under implementation***

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MAIN MESSAGES

- The state of São Paulo has biomethane **potential that could boost a new industry linked to the bioeconomy,** a vocation of the state, **and to equipment and services for biomethane.**
- **Benefits**: reduction of carbon emissions, job creation, strengthening of the sugarcane energy industry and neo-industrialization (equipment and services for the production and consumption of biomethane)
- Key incentive measures linked to plant CAPEX to **reduce the cost of biomethane** are needed to increase demand for biomethane, especially in industry.
- Measures related to **replacing diesel in transportation** can boost demand distributed across the territory and make the industry even more competitive.
- **Separating the molecule from its environmental attribute** in negotiations and contracts is essential to avoid burdening industry/consumers and to enable the generation of more revenue from biomethane.
- There is no "silver bullet" to transform the biomethane market. **Coordinated measures in the supply, logistics, and demand of biomethane** must be implemented.
- São Paulo should view the **development of the biomethane** market and industry as **strategic for industrial development**, leadership in the energy transition, and advanced fuels.
- **Incentive measures** of the portfolio **should form part** of a State Biogas and Biomethane **plan or program.**

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QUESTIONS AND COMMENTS

To access the executive summary, technical report and detailed presentation video:

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