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Opportunities and Challenges for Biomass Supply Chains



Biomass Transportation Systems in Brazil: The Cases of the Ethanol Industry and the Constraints for Exporting Pellets

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- Logistics in the sugarcane sector: the agricultural stage and ethanol distribution.
- Constraints for pellets production and commercialization.
- Conclusions.

Logistics in the sugarcane sector

From the field to the mill

Source: Caixeta Filho (2012)

- The stage that is called CCT (in Portuguese) (Harvesting, Loading and Transportation) represents about 35% of the total costs of sugarcane (i.e., about 20% of ethanol production costs).
- The current tendency is mechanical harvesting, with use of large trucks to transport sugarcane to the mill.
- The current practice leads to high level of soil compression, impacting productivity.
- Mechanization has lead to a new paradigm on CCT.
- How do handle sugarcane straw is still an open issue.

| DESCRIÇÃO | ILUSTRAÇÃO | NOME POPULAR | CAP. (MÉDIA) DE TRANSP. |
|--|---|---------------------|--------------------------------|
| Caminhão plataforma com um reboque acoplado |  | Romeu e Julietta | 25 t/viagem |
| Caminhão plataforma com dois reboques acoplados |  | Treminhão | 45 t/viagem |
| Cavalo mecânico com dois semi-reboques acoplados |  | Rodotrem | 65 t/viagem |

- Efforts for optimizing the operation: reducing idle time, losses of sugarcane, reducing shipment.

- Traditional loading after manual harvesting





- Mechanical harvesting with some degree of separation between sugarcane and trash

After mechanical harvesting





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At the mill



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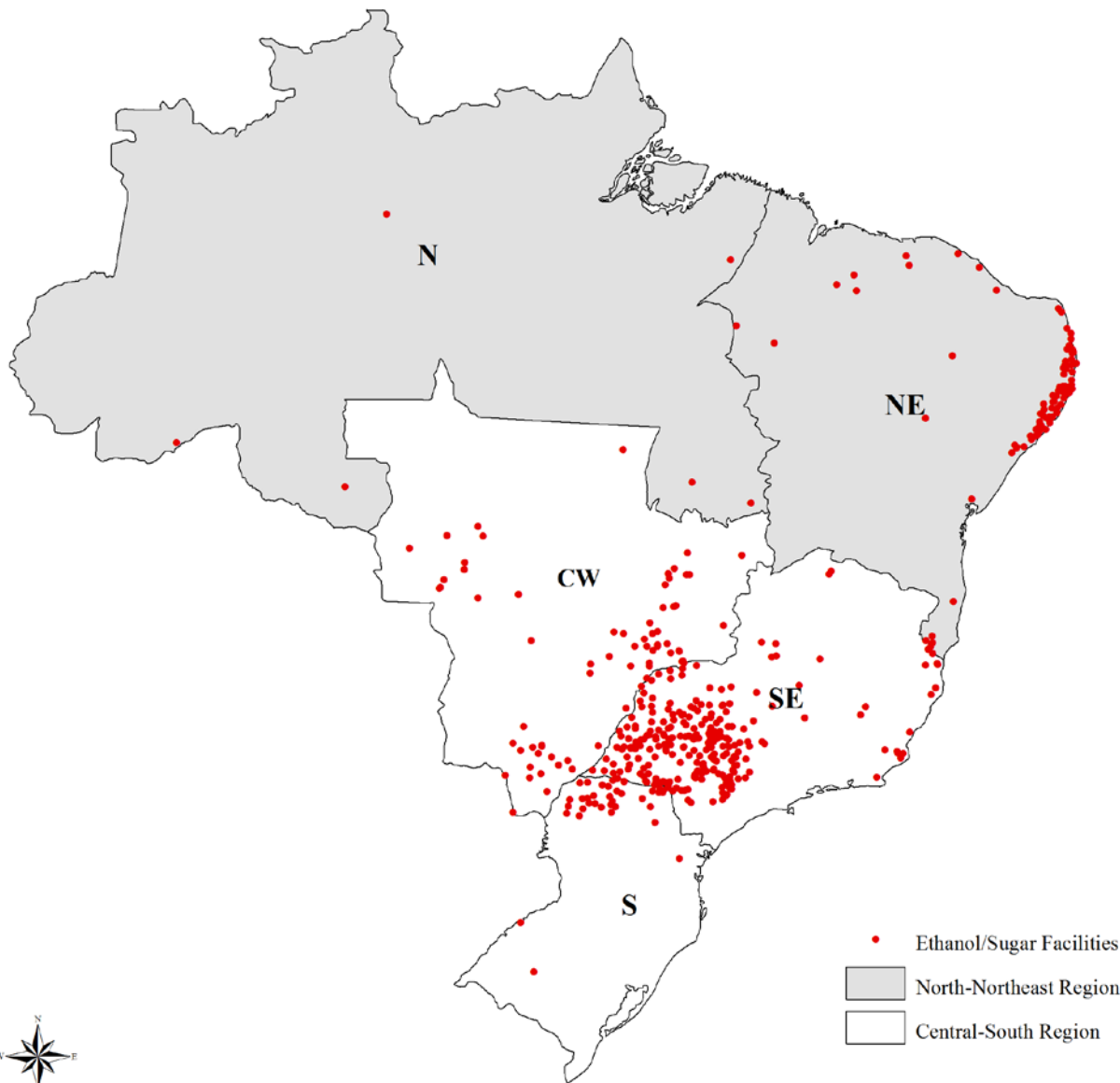


Logistics for ethanol



Location of sugarcane mills

Source: Walter et al. (2014)



0 1 2 4 6 8 Decimal Degrees



Railways in Brazil

Source: ANTF (2014)





- In 2013, 87% of the total export (about 2.6 BL) were shipped in Santos and 10% in Paranaguá.

From the mill to the consumer

Source: Milanez et al. (2010)

- Due to the short distances and the relatively small volumes, in general ethanol flows by trucks from the mills to the distribution centers.
- About 80% of the ethanol produced moves from the distribution centers to the gas stations. About 20% of the production is transferred among distribution centers. Trucks are used in a large extent.
- The same (i.e., by far the transport by trucks) regarding the displacement of ethanol to the ports.
- **The same picture in December 2013, according to Grupo de Pesquisa e Extensão em Logística Agroindustrial (Esalq-Log).**
- In 2007 it was estimated that the transportation cost from the mill to the ports was 45-70 US\$/m³, i.e., 10-16% of the FOB price of exported ethanol (CGEE, 2010).

Typical trucks used

Source: Caixeta Filho (2012)



Carreta
5 a 6 eixos

Até 2001 - 30 a 35 m³



Bi-trem
7 eixos

2001 - 45 m³



Rodo-trem
9 eixos

2004 - 60 m³

Transport by railways and pipelines

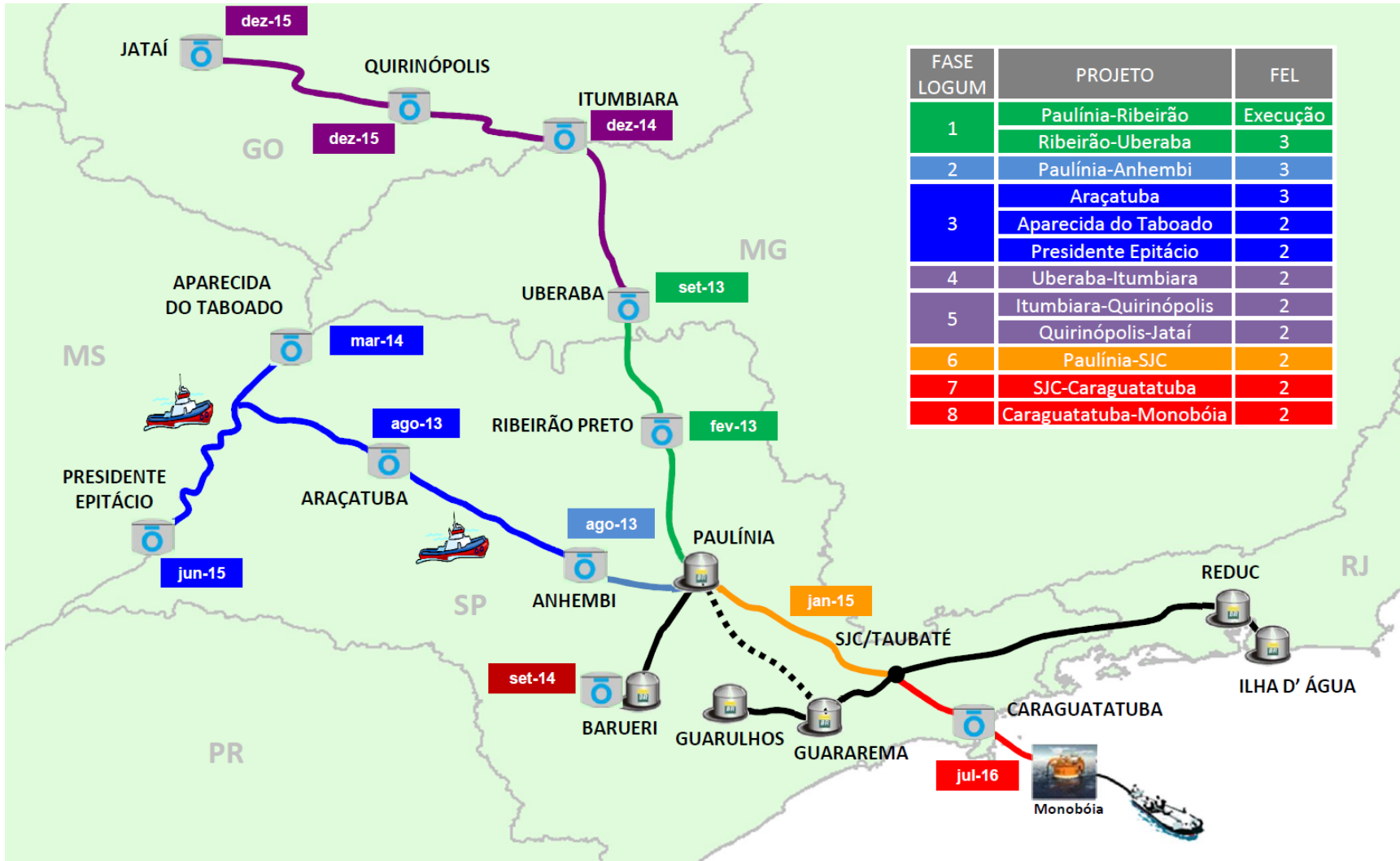
Source: Milanez et al. (2010)

- The best infrastructure for transporting ethanol by railways is in the South region (it is not the main producer region). 1.6 BL were transport by railways in 2008 and about 2.7 BL in 2009.
- In state of São Paulo (the largest producer), the average distance from the mills to the consumer market is 230-410 km. However, the use of railways has been extended.
- The feasibility of a pipeline with 500 km requires a minimum volume of about 4.5 BL/y. The investment would be about 1 million US\$/km.
- In 2009, about 1 BL were transported by pipelines (basically, from storage units to the ports).

Focus on pipelines

Source: Logun (2013)

- Project to be developed from 2011 to 2020, with about 1,300 km of pipelines and capacity for 20 BL/y.



Actions by Petrobras (1)

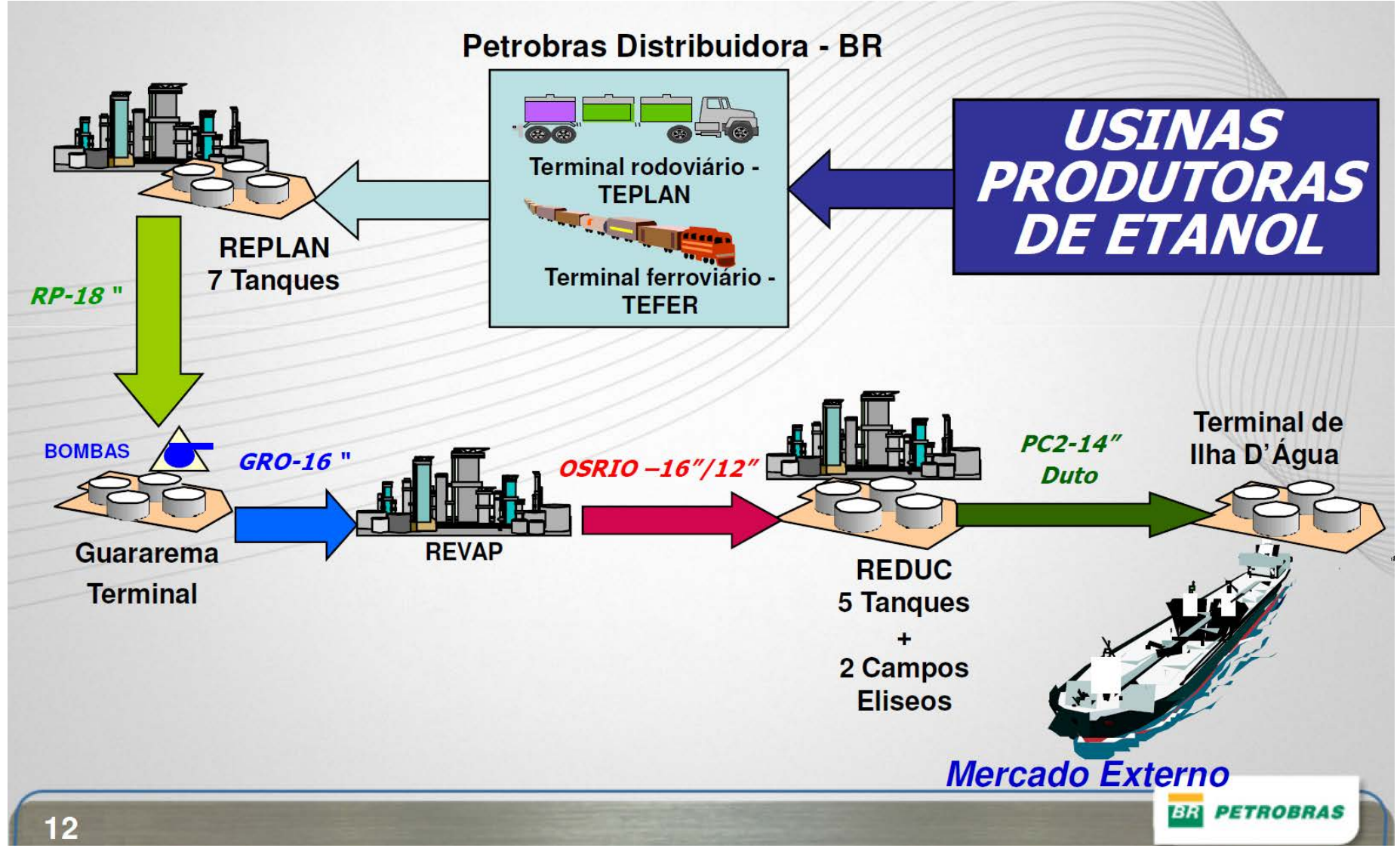
Source: Cao (2012)

- The combined use of pipelines and boats. Nominal capacity in top right-side.



Actions by Petrobras (2)

Source: Cao (2012)



Constrains for producing and exporting pellets

Sources: Serrano (2009)

- In a study considering production of pellets from wood residues in Brazil it was estimated that the logistic cost in Brazil represented about 10% of the CIF price in Europe (in the reference case).
- However, transporting pellets by trucks (due to the small level of production), the break-even would be a distance of about 200 km; for 300 km the production wouldn't be feasible at all.
- Feasibility analysis by different investors, considering the use of industrial and agricultural residues, showed that the logistic costs is the main constrain.

Constrains for producing and exporting pellets (2)

Sources: Suzano (2012)



- Suzano is one of the majors producers of pulp and paper in Brazil.
- The company considered the production of pellets (2 Mt/y) from a dedicated eucalyptus plantation in NE Brazil.
- Even with a existing infrastructure, the project failed.

- Mechanical harvesting is a strong driver for changes on logistics in the sugarcane industry. Straw recovery is still a challenge.
- Logistics is an important drawback for large-scale production of bioenergy in Brazil (even for the well-established sector ethanol production).
- The logistic costs would be a serious barrier for exporting ethanol from more remote regions.
- For pellets, the lack of good railways is one of the most constrains. Investments should be in specific regions.
- It is necessary to (urgently) invest on railways, pipelines and on improving the ports!

Please, keep in touch

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Thank you!