

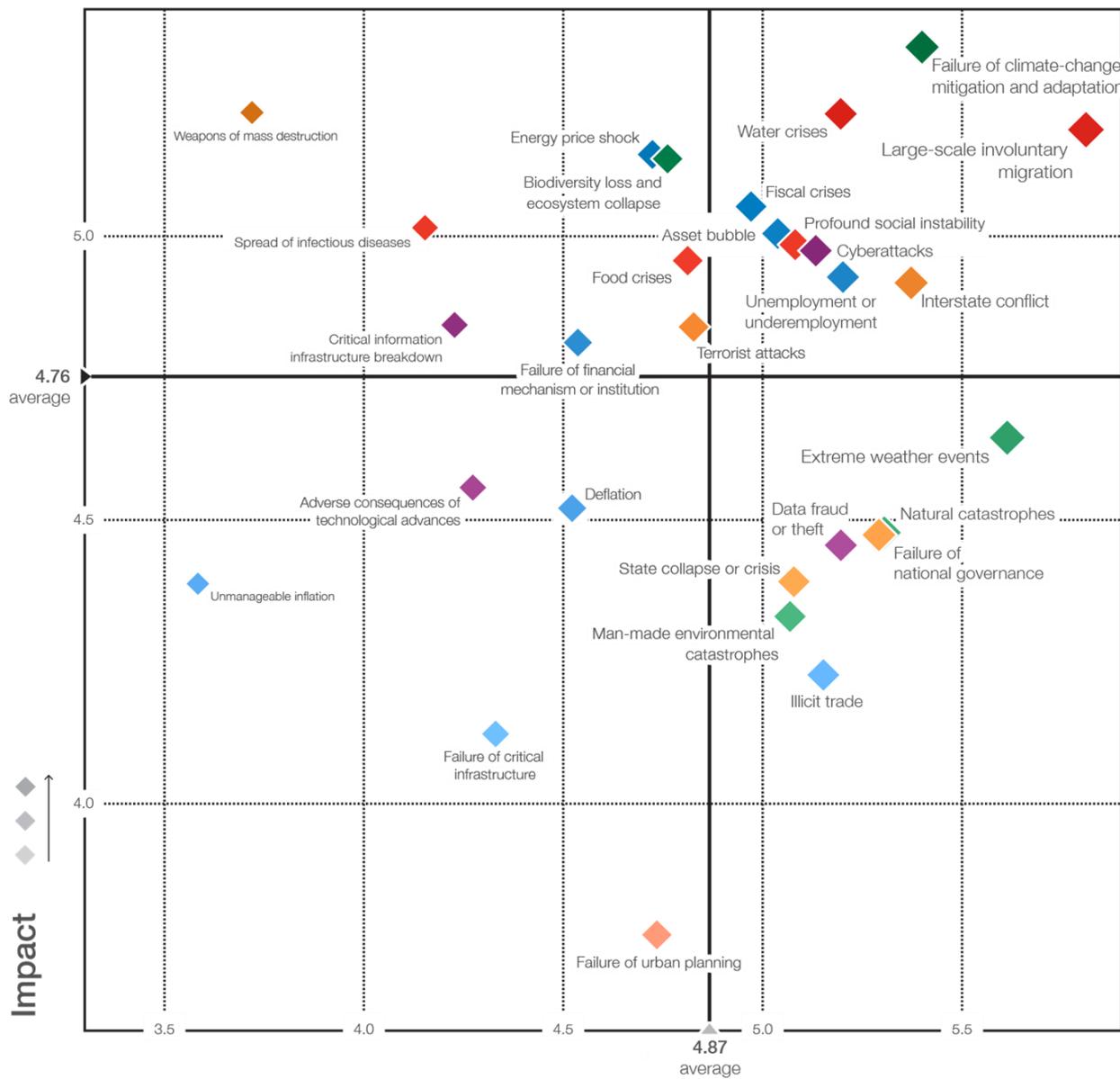


Desafios e oportunidades da produção de bioquímicos e biocombustíveis 2G

ENZITEC
Jul 2016



MUDANÇAS CLIMÁTICAS



Custos:

No último ano, os custos para mitigação das emissões de CO₂ no mundo chegaram a US\$3,7 trilhões

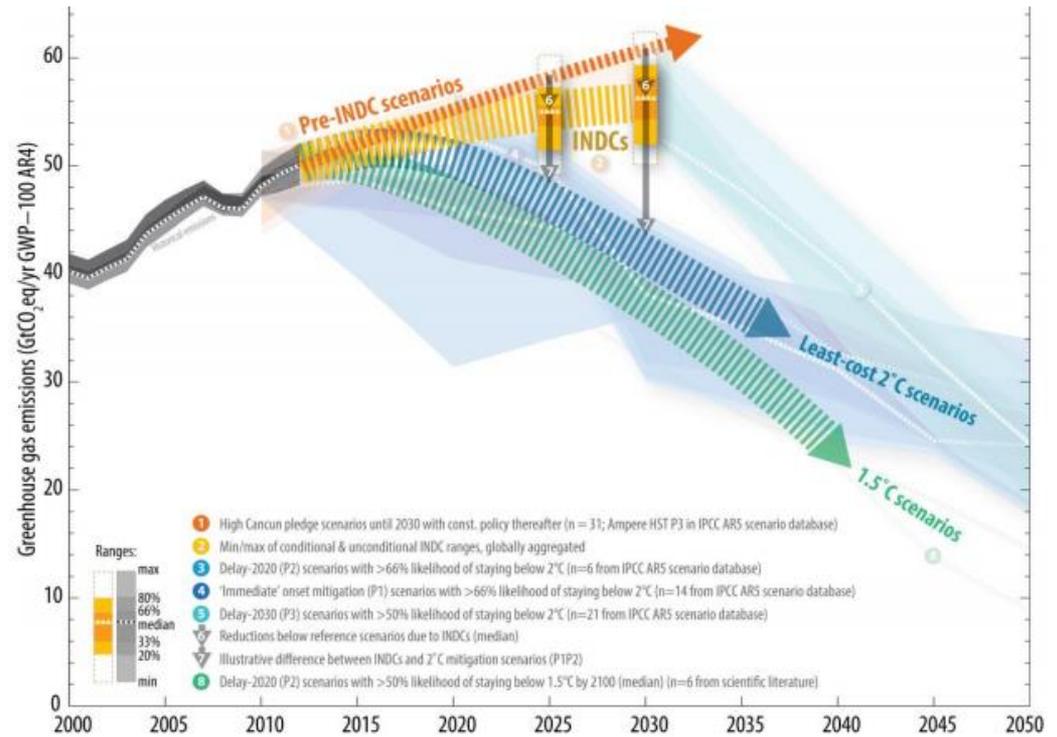
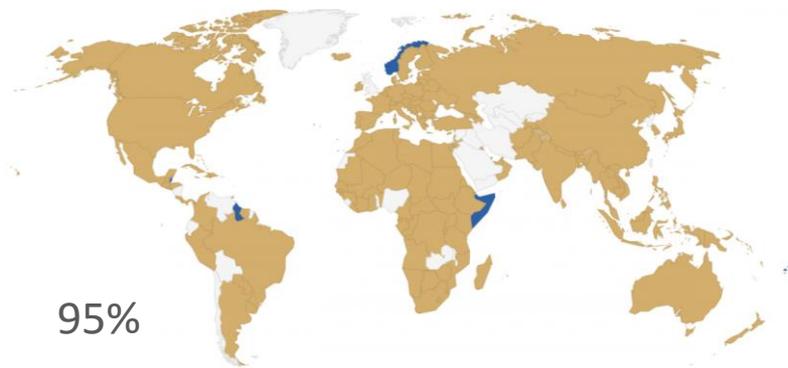
Categories

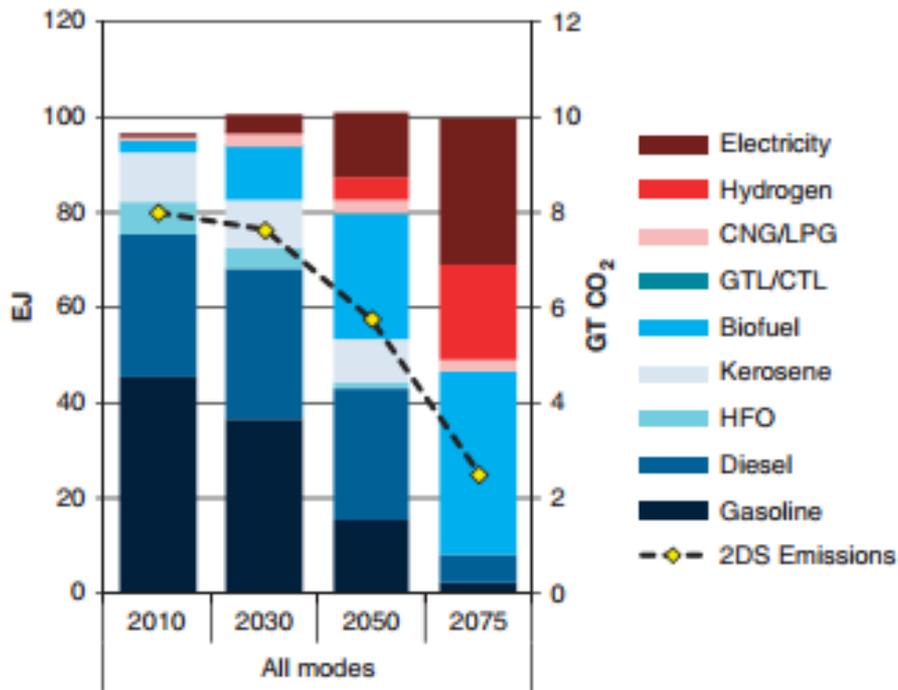
- ◆ Economic
- ◆ Environmental
- ◆ Geopolitical
- ◆ Societal
- ◆ Technological

Likelihood



Acordo mundial para limitar a elevação da temperatura média global em até 2°C até o final do século.

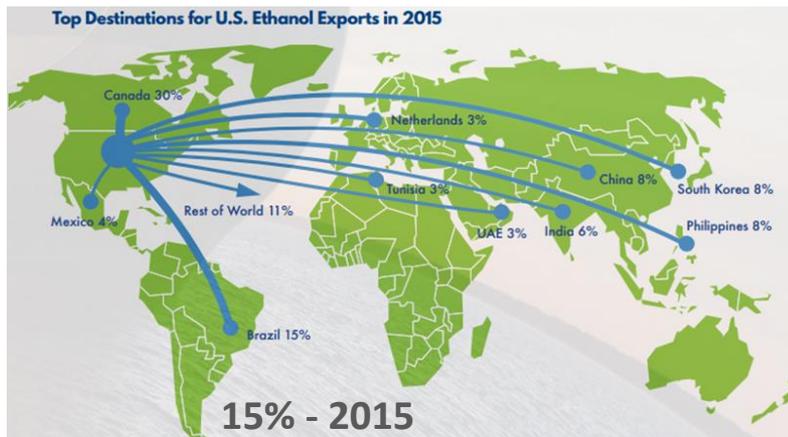




- Redução da demanda
- Aumento da eficiência
- Substituição da matriz energética

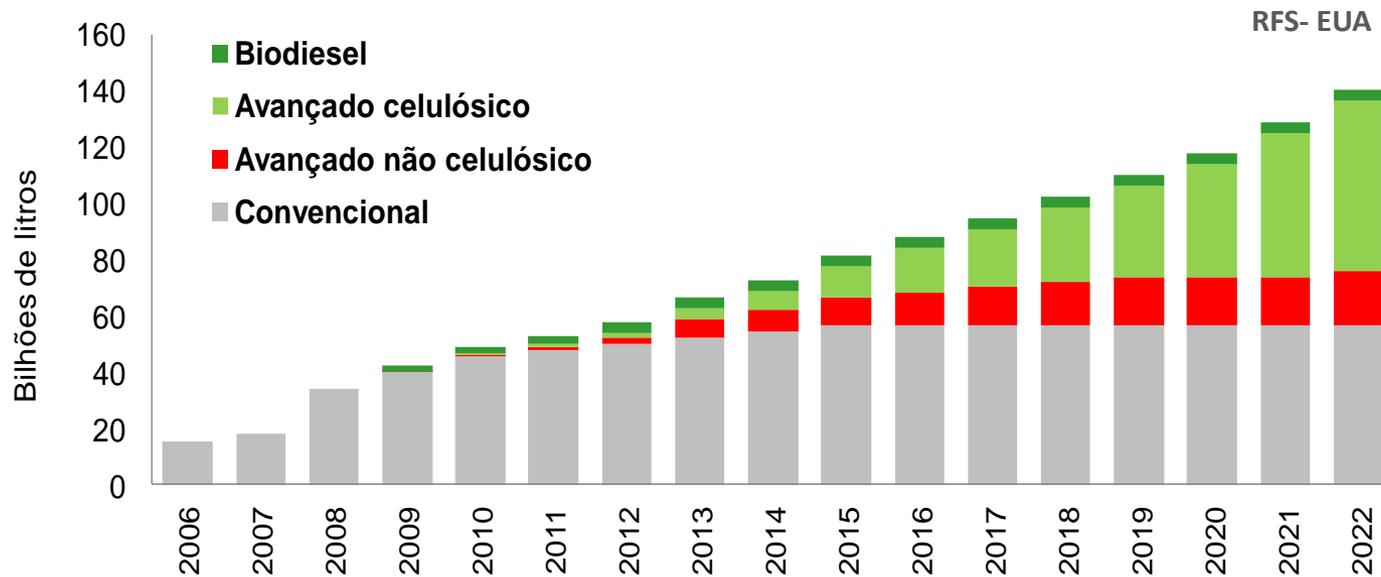
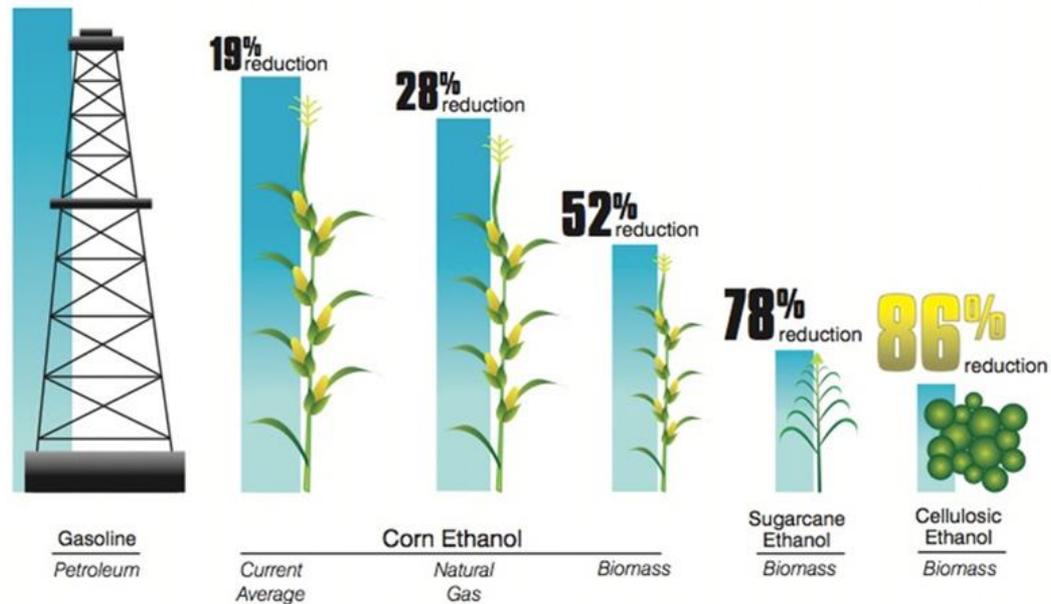
iNDC Brasil - reduzir em 43% as emissões, com relação aos níveis de 2005.

... “aumentar a participação de bioenergia sustentável na matriz energética brasileira para aproximadamente 18% até 2030, expandindo o consumo de biocombustíveis, aumentando a oferta de etanol, inclusive por meio do **aumento da parcela de biocombustíveis avançados (segunda geração)**”.

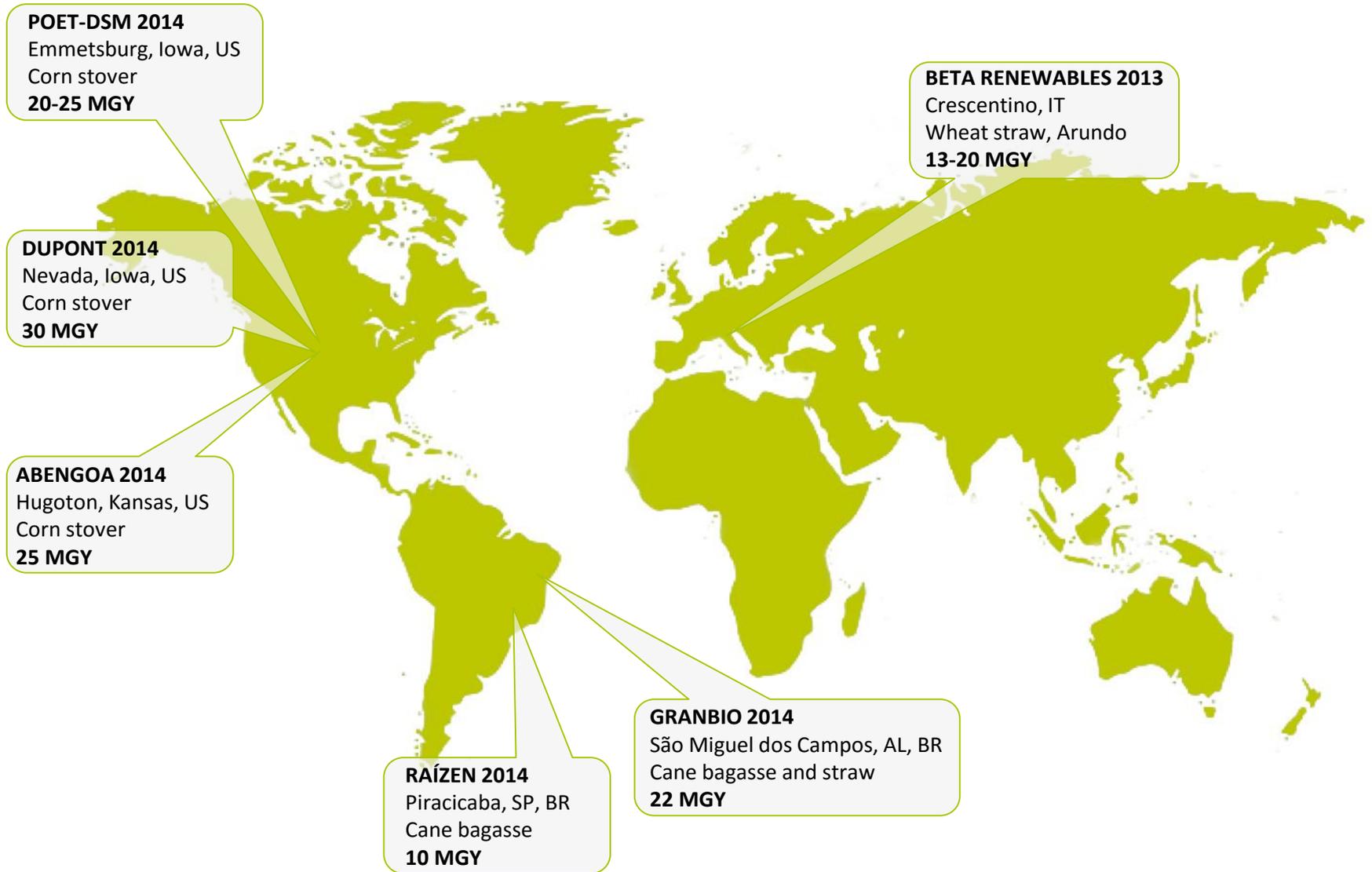


Déficit Acumulado

15 a 25 bilhões
de litros



ETANOL 2G: PLANTAS INDUSTRIAIS CONSTRUÍDAS





Janeiro 2013



Janeiro 2014



Primeira fábrica de etanol 2G do
Hemisfério Sul – Set/2014

COLHEITA DE PALHA

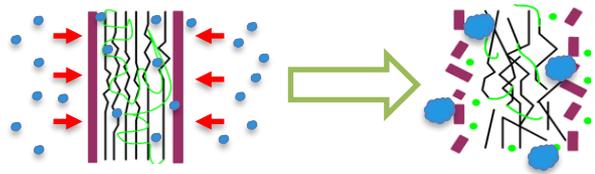


ESTOQUE DE PALHA

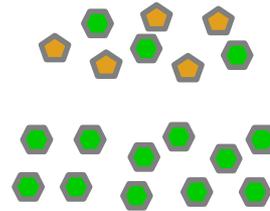


EVOLUÇÃO DO PROCESSO

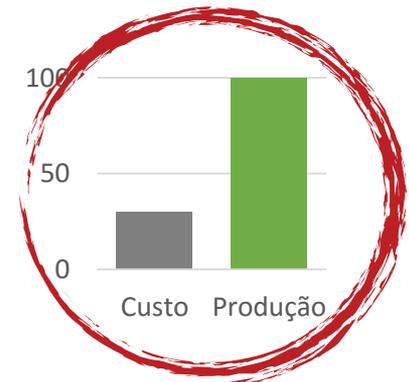
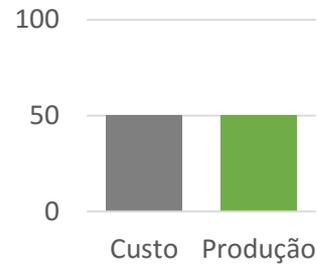
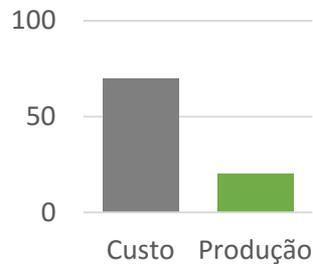
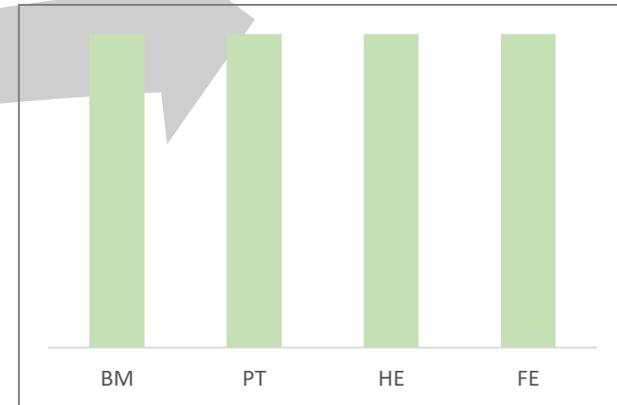
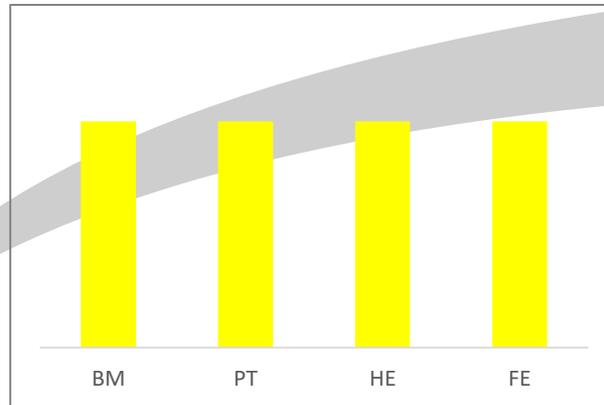
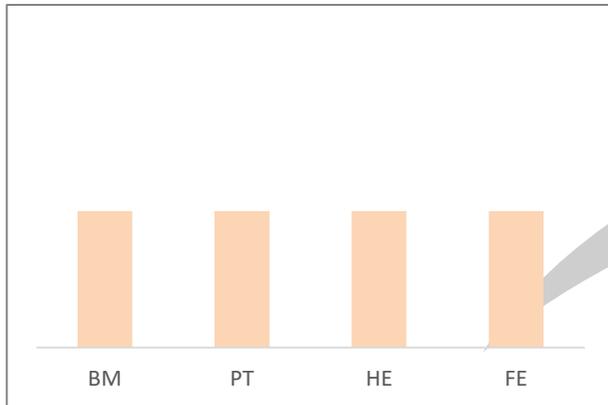
Pré-tratamento (PT)

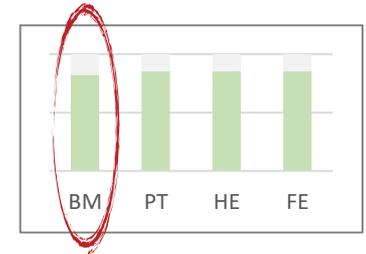
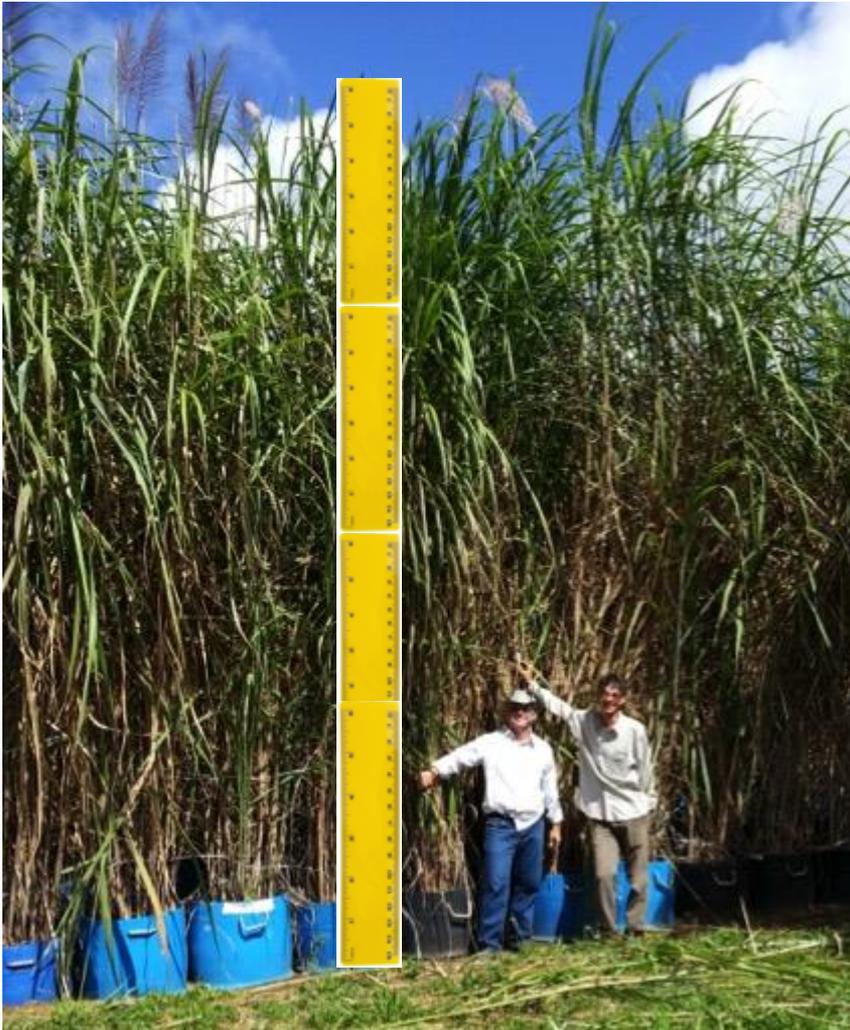


Hidrólise (HE)



Fermentação (FE)





**Mais produtiva,
mais robusta e mais
sustentável** que
a cana convencional

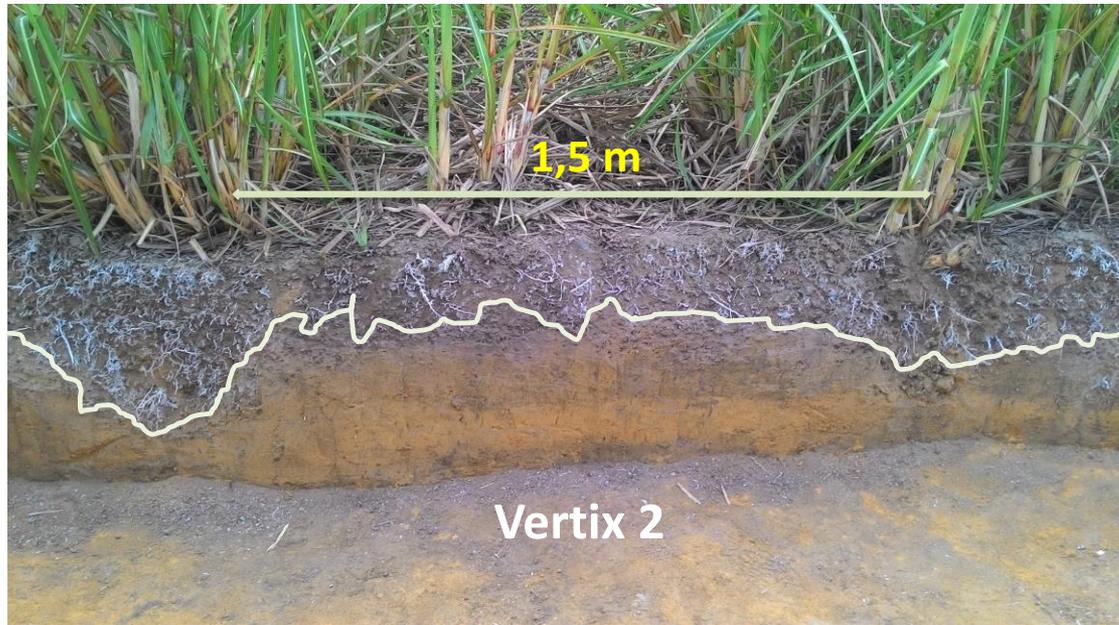
=



X



S. spontaneum



**Cana
convencional**

Cana-energia

**Cana Planta
Idade: 7,5 M
Precipitação no Período: 350 mm**

COMPARATIVO: CANA-DE-AÇÚCAR X CANA-ENERGIA

Características	Cana-de-açúcar ⁽¹⁾	Cana-energia
Fibra	17,4%	35%
Açúcares	12,6%	7%
Produtividade (massa verde ton/ha) ⁽²⁾	92	250
Produtividade (fibra ton/ha)	16	88
Produtividade (açúcares ton/ha)	12	18
Ganho Genético (ao ano)	1,5%	3%
Exigência em Fertilidade	Alta	Baixa
Resistência à pragas e doenças	Baixa	Alta
Colheitas (por ciclo)	5	10
Taxa de Propagação	1:10	1:400
Ciclo de Melhoramento (anos)	8 a 12	4 a 6

Notas:

(1) Considerando a colheita de 50% da palha (TCH de 80)

(2) São Paulo, Ambientes D e E (baixa fertilidade)



Colheita mecânica



Moagem

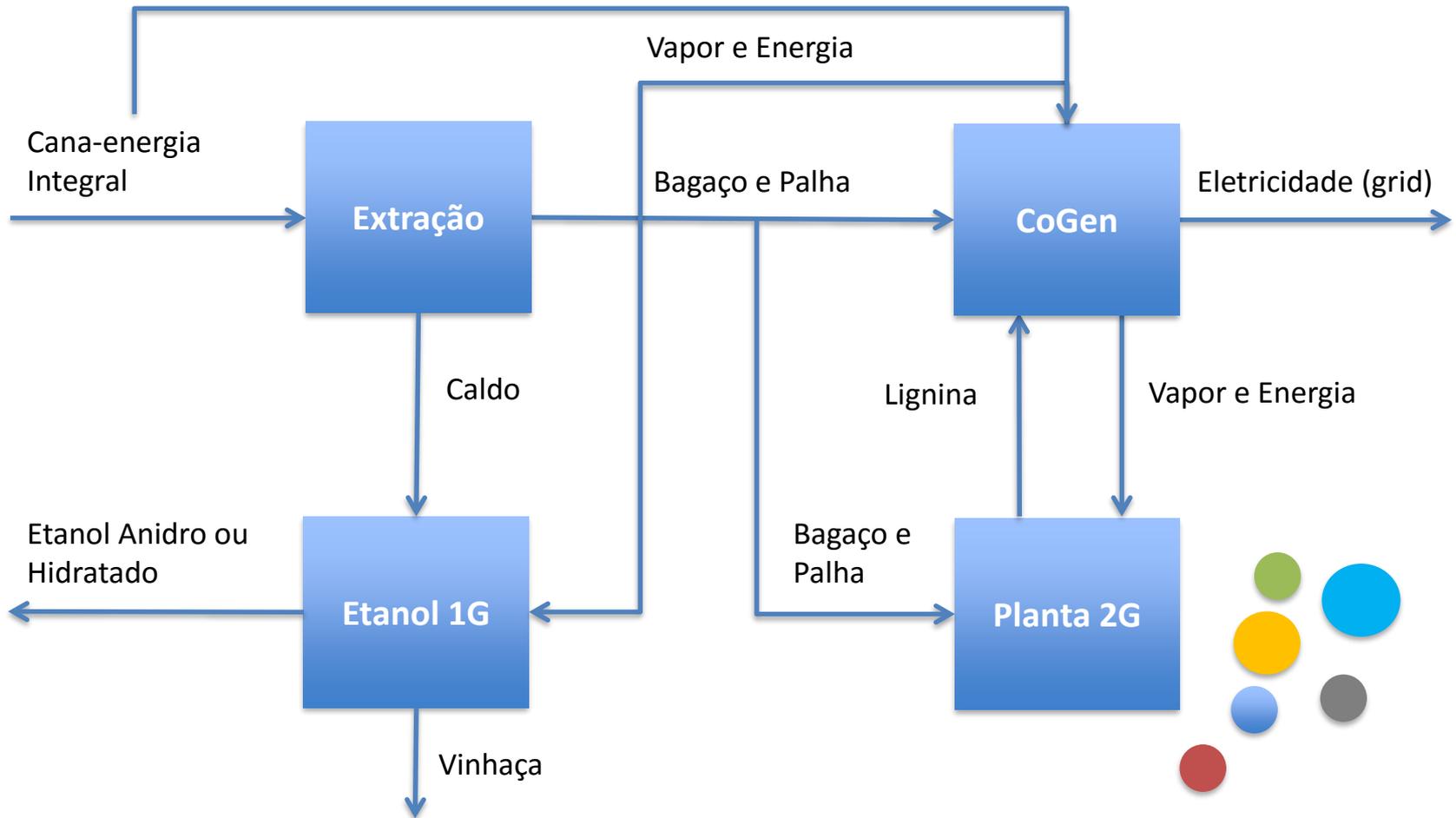


Fermentação

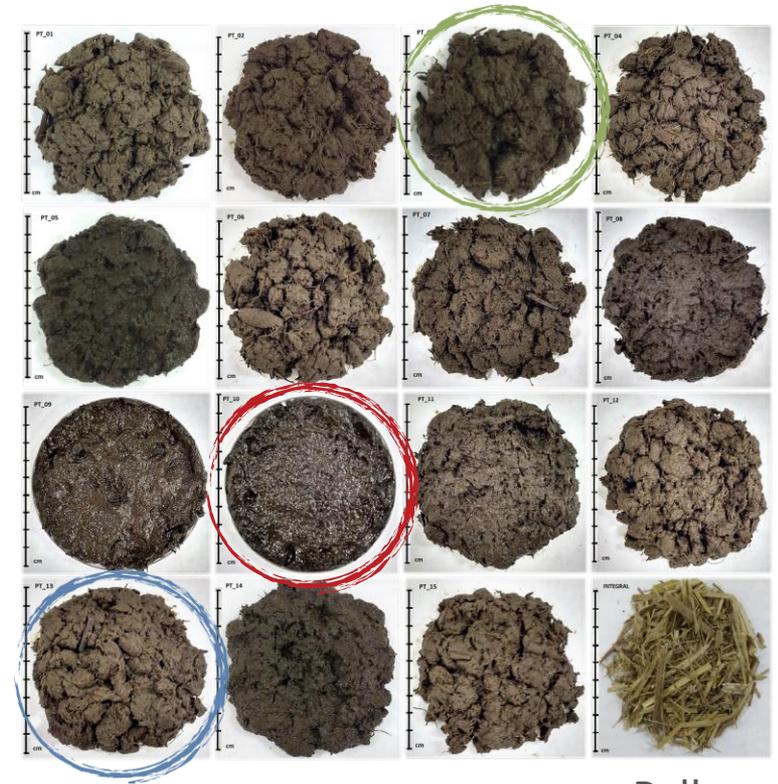
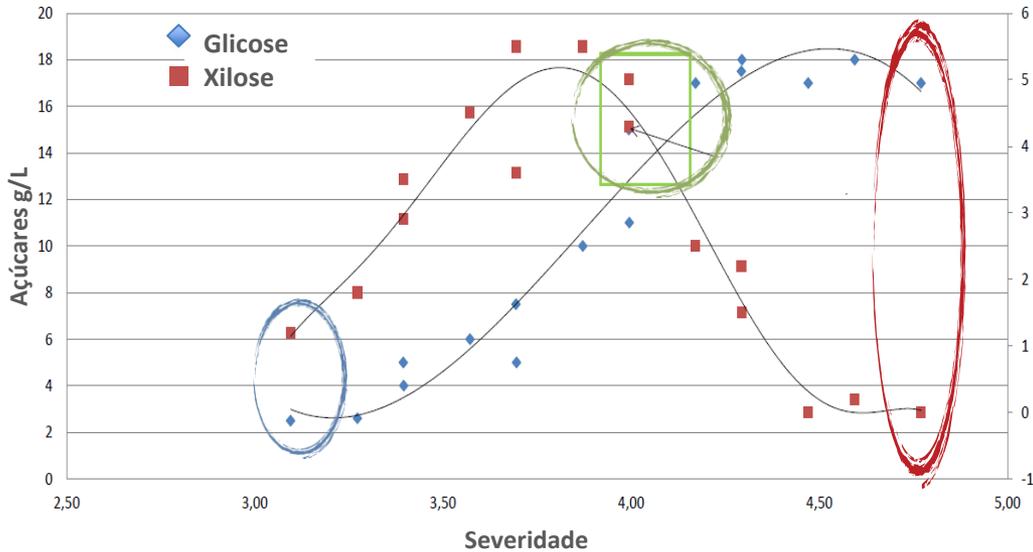
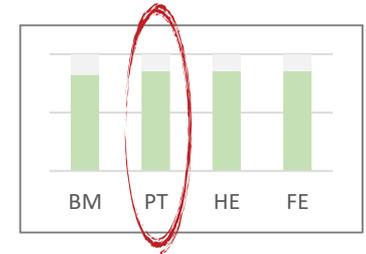


Queima

MODELAGEM PARA PROJETOS 1G, 2G, COGEN E COMBINAÇÕES

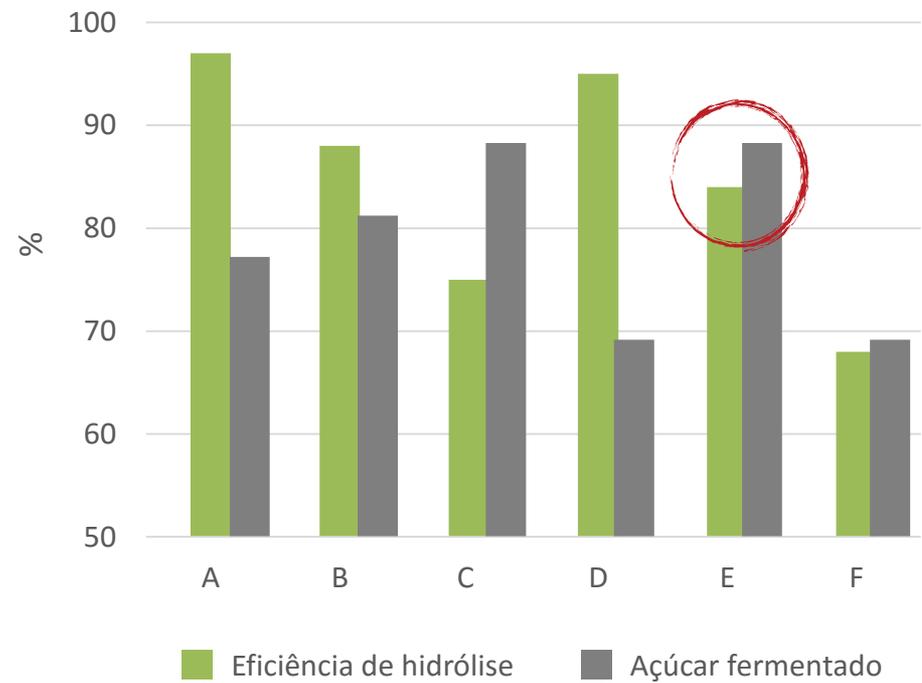
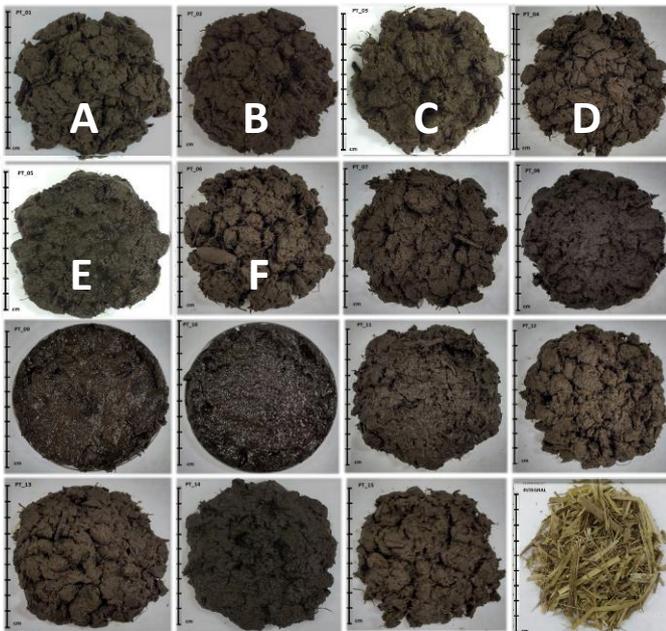


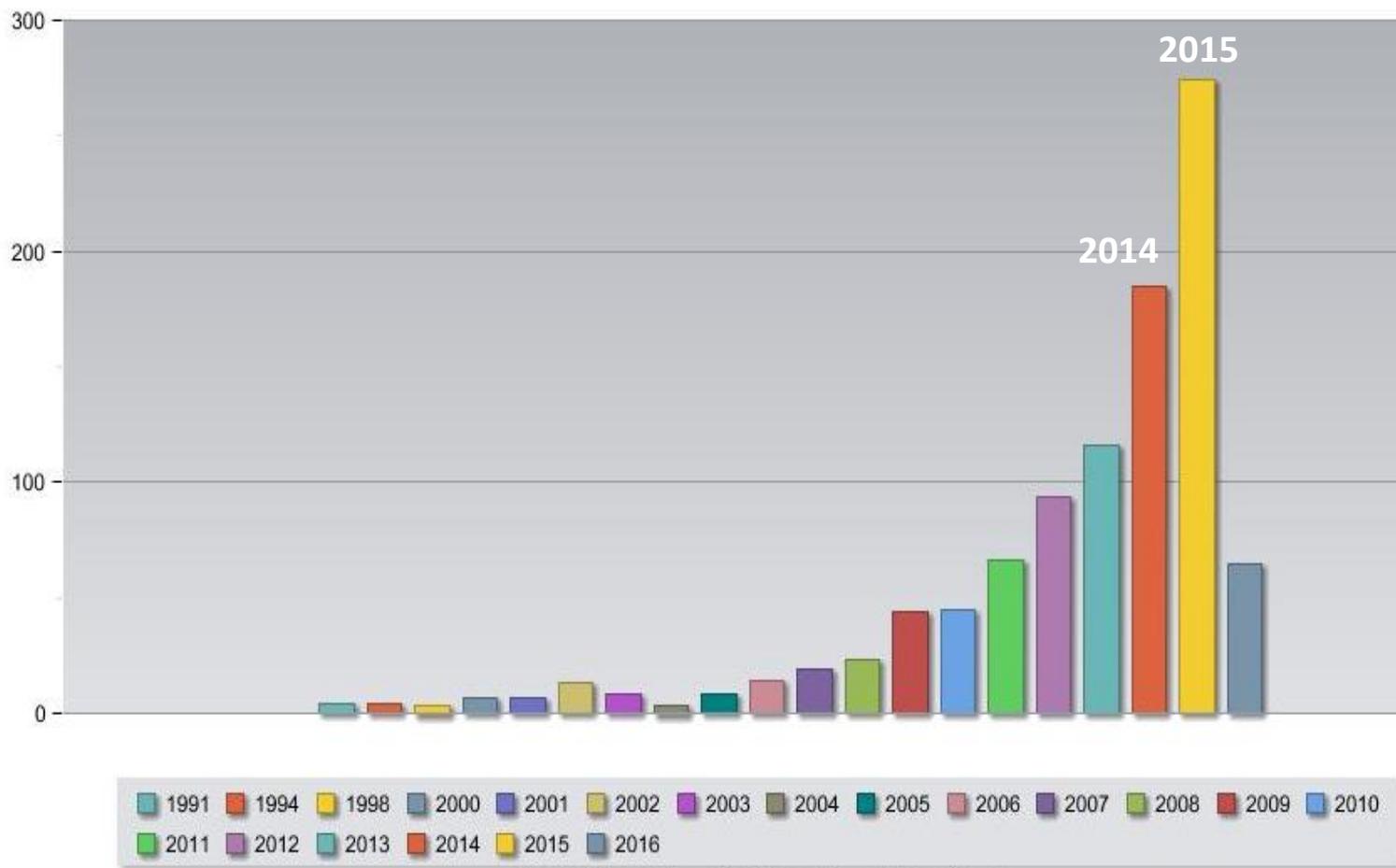
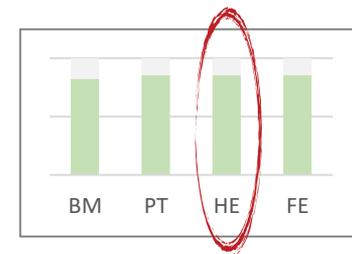
- Acessibilidade
- Baixa degradação e inibidores
- Pureza dos açúcares



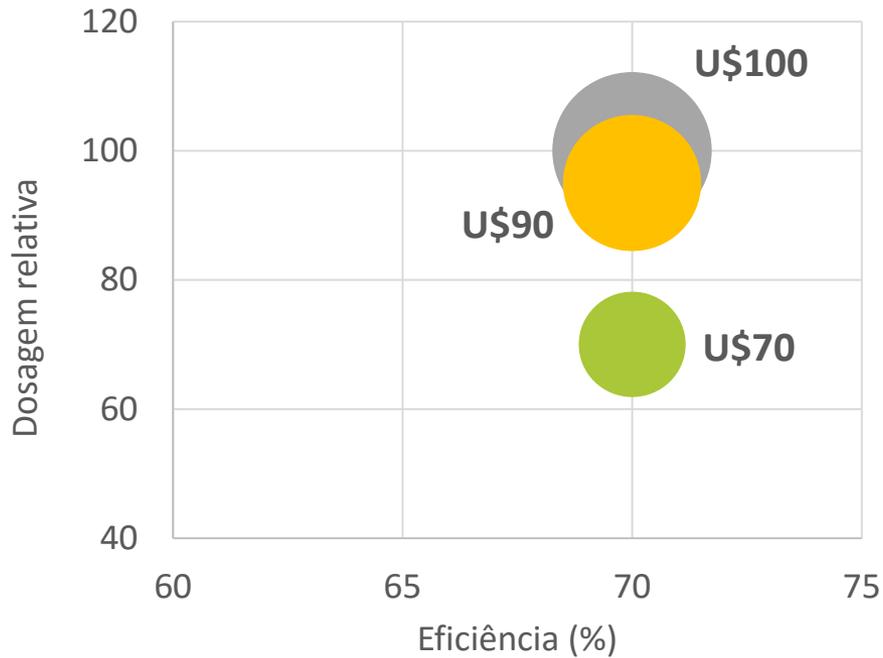
Palha

OTIMIZAÇÃO PRÉ-TRATAMENTO: HIDRÓLISE E FERMENTAÇÃO



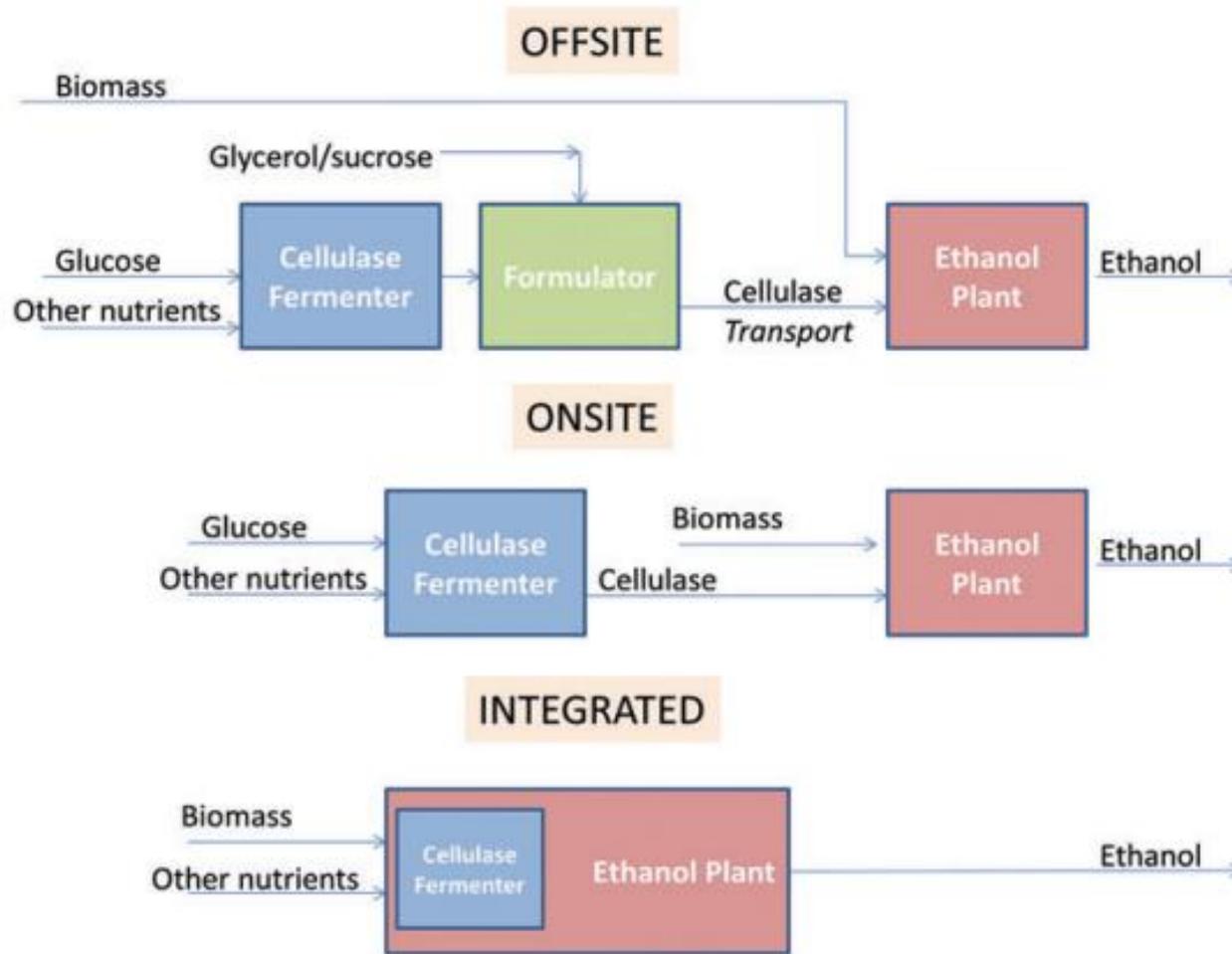


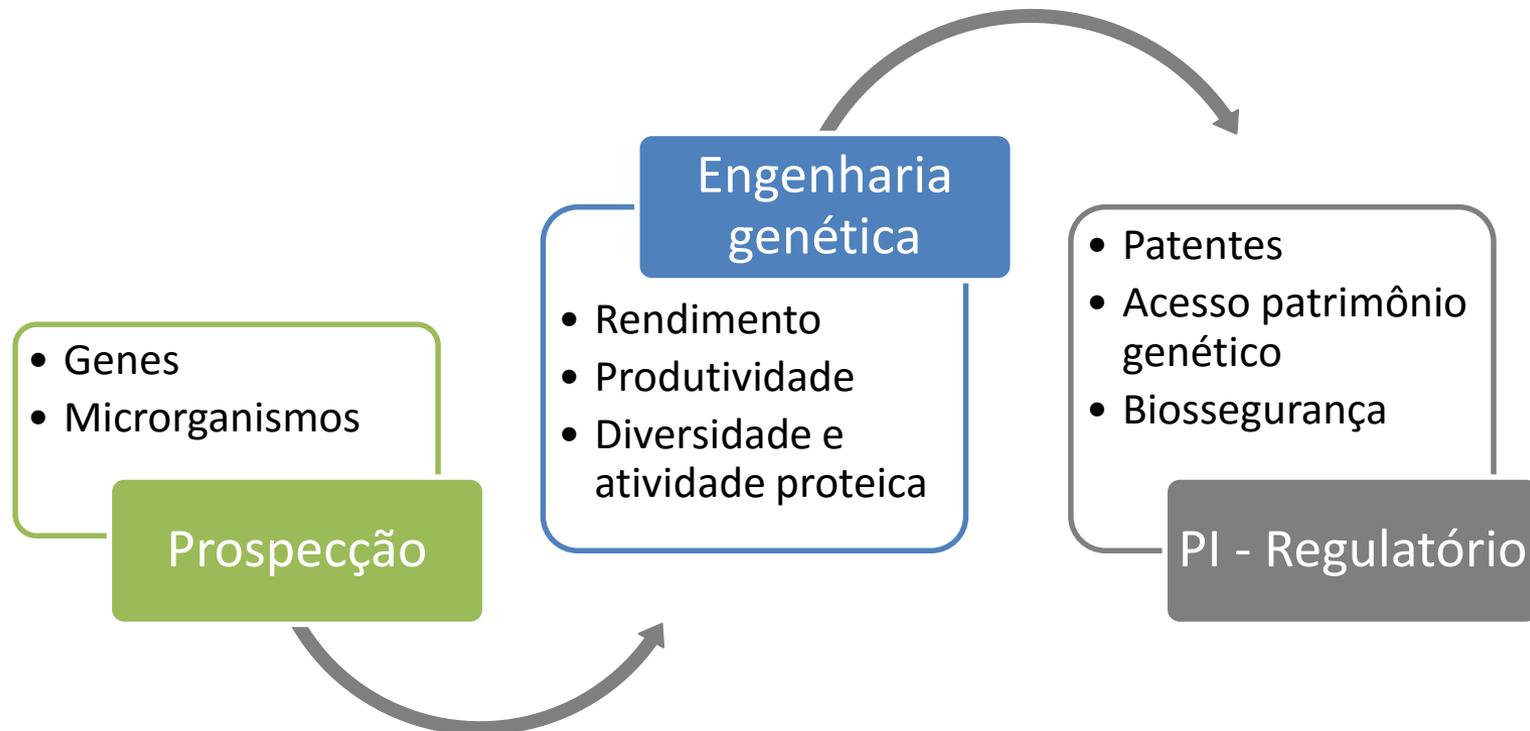
Source: Thomson Innovation®, www.thomsoninnovation.com



● Versão 1 ● Versão 2 ● Versão 3

- Novos entrantes
- Customização
- Aumento de atividade
- Diversidade enzimática
- Acessibilidade da biomassa





Produção (integrada e comercial)

- Baixo custo
- Flexível para diferentes materiais



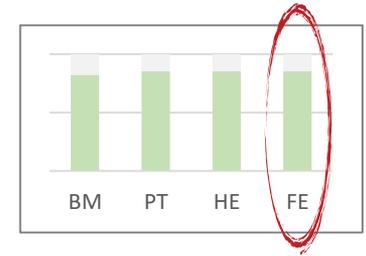
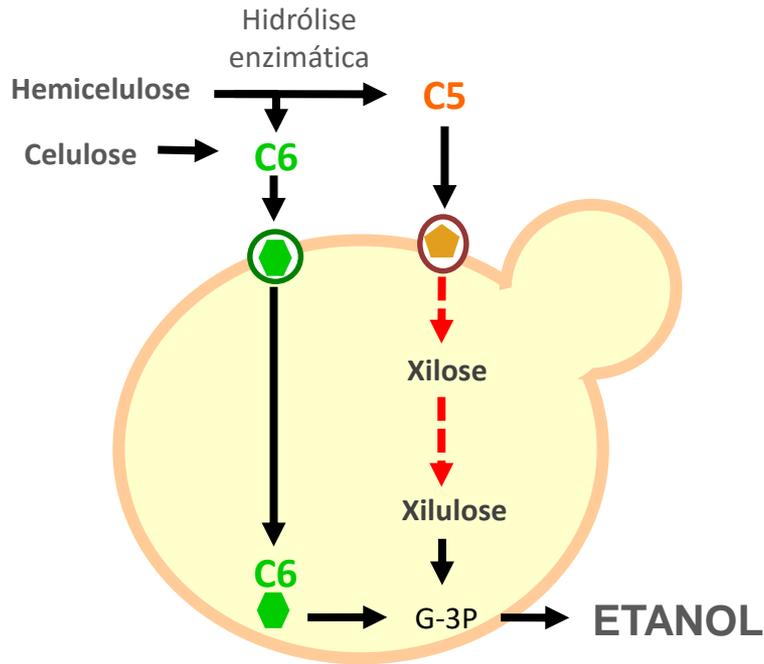
Hidrólise enzimática:

- Trabalho com alta carga de sólidos >20%
- Eficiência >70%
- Tempo <70h

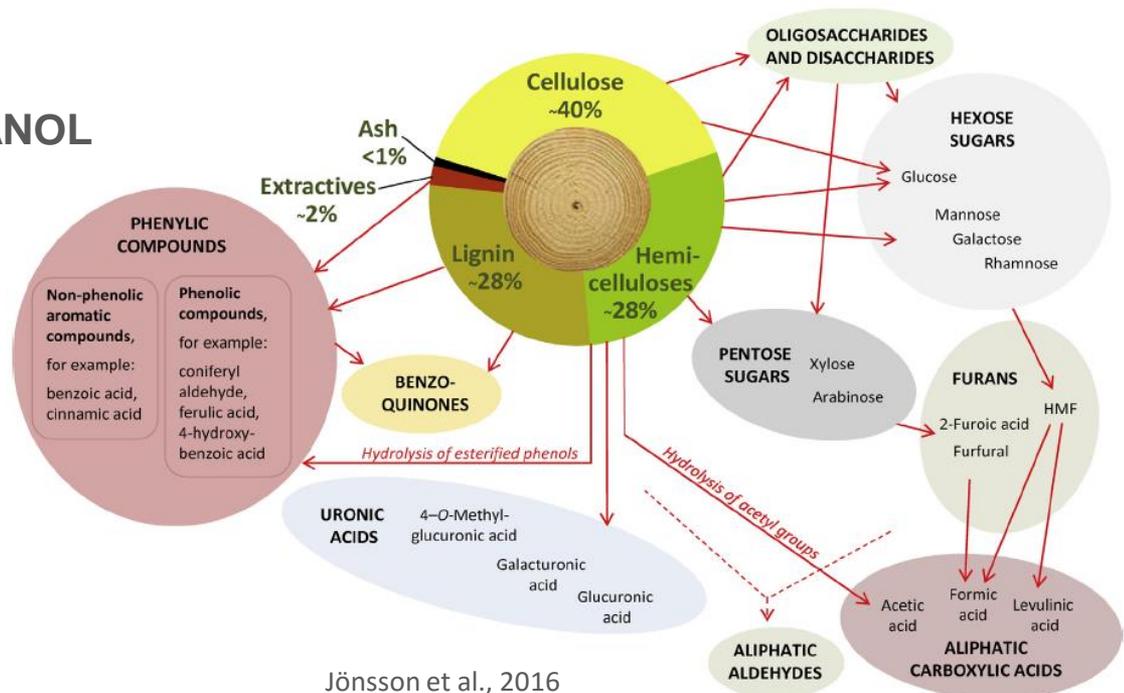
Rendimento global:

Biomassa	Aç. Mono	PT	HE	FE	Etoh	Y
100	0,68	0,9	0,65	0,45	17,9	5,6
			<u>0,60</u>	0,45	16,5	6,1

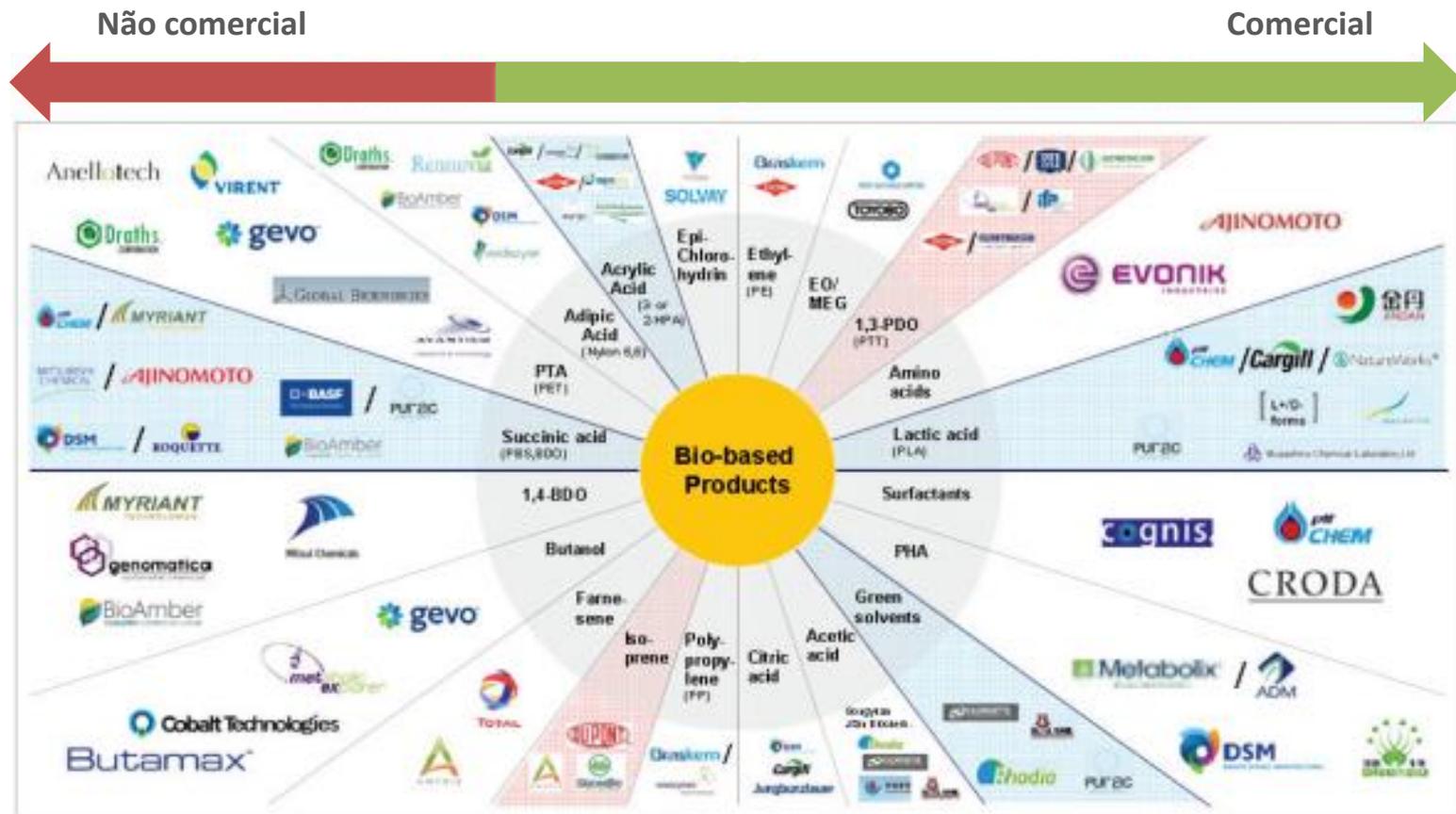
5,5 mi L etanol



- Rendimento
- Produtividade
- Sólidos (açúcares)
- Temperatura (SSF)



Jönsson et al., 2016

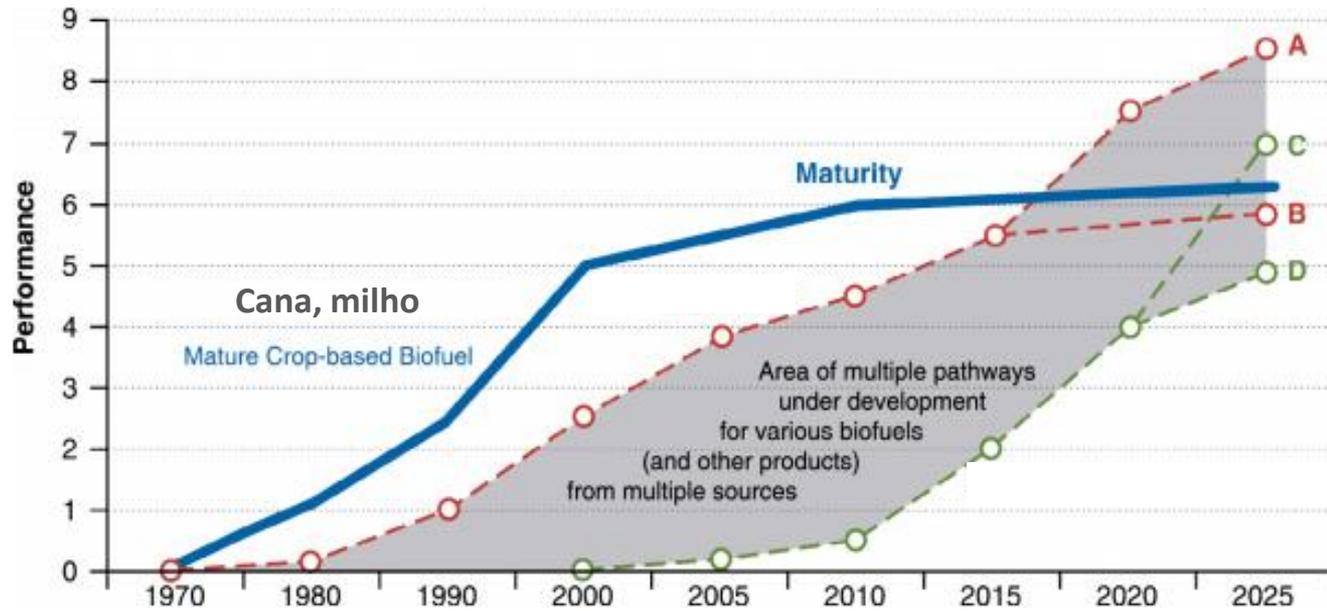




Brazil provides

- \$4.9 billion**
in national subsidies
- \$3.3 billion**
in public finance
- \$41.5 billion**
in state-owned enterprise investment

CURVA DE EVOLUÇÃO



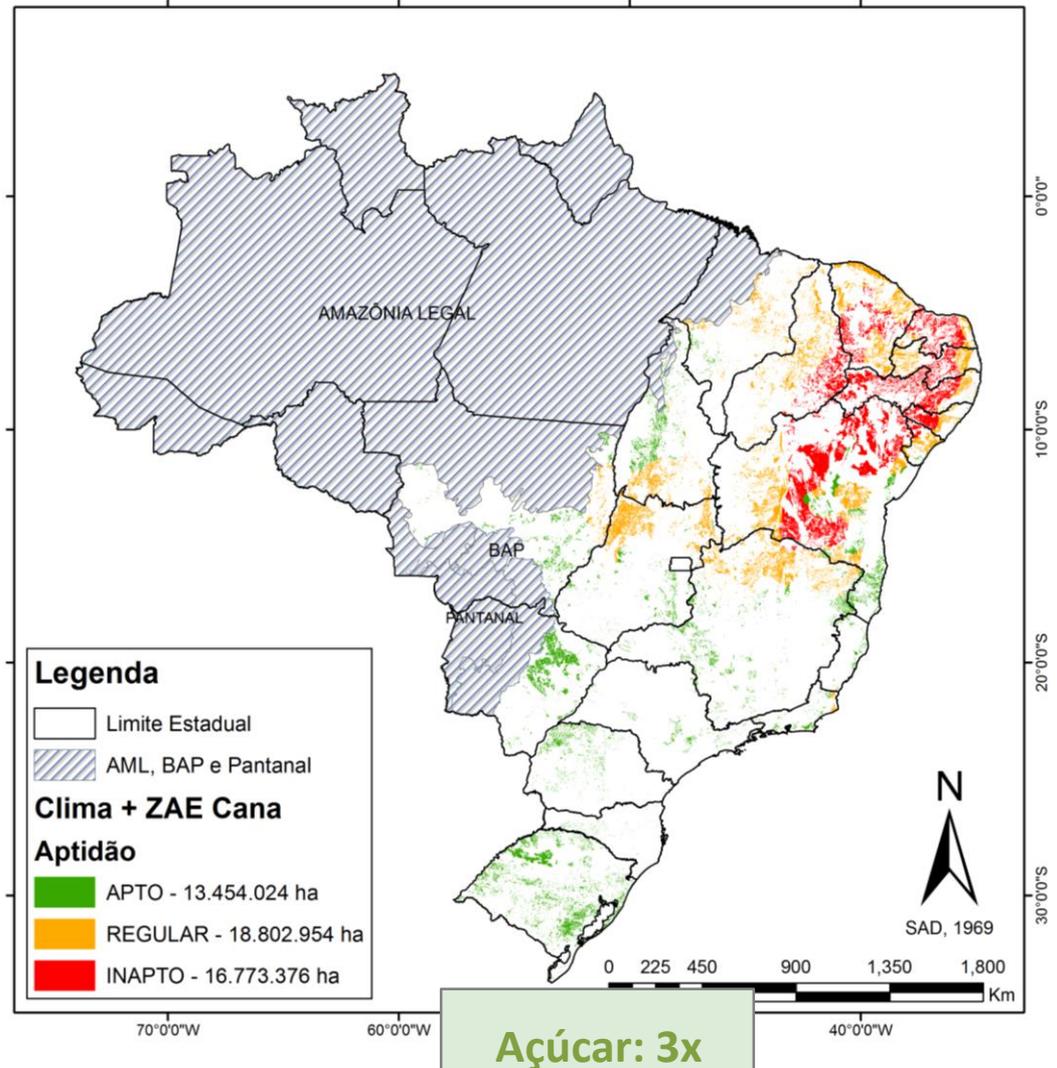
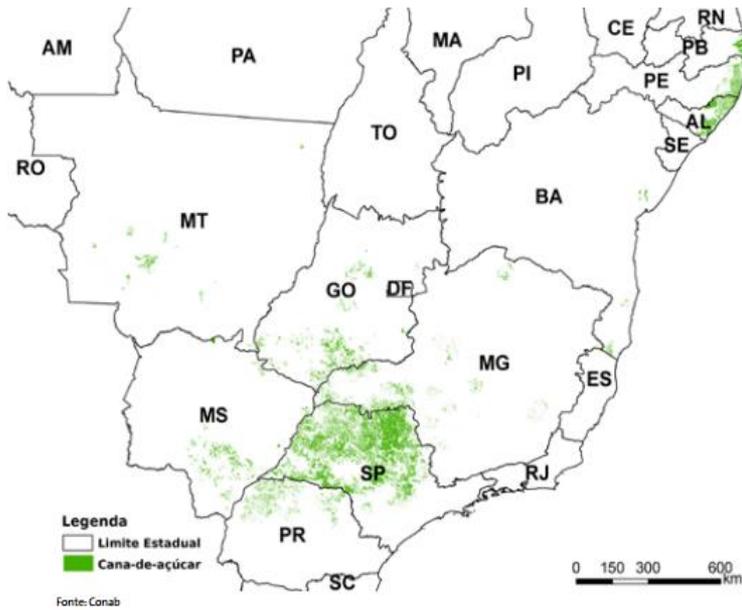
*...while **there are more than \$4 trillion of products** made by chemical transformations globally, only about **5 percent** of these potentially “addressable markets” **have been addressed biologically.***

*McKinsey Global Institute estimates that synthetic biology and the **industrialization of biology** will provide a disruptive set of technologies with an economic impact of at least **\$100 billion by 2025.***

*... at least **20 percent of today’s petrochemical production** can be replaced by the **industrialization of biology** in chemical manufacturing over the next decade.*

*As a result, **a robust and disruptive new industrial ecosystem** is emerging.*

Cana-de-açúcar: 10 milhões



Açúcar: 3x

Fibra: 6x

32 milhões de hectares disponíveis



Futuro: clusters com biorrefinarias flexíveis de larga escala em áreas de baixo potencial agrícola

A landscape photograph featuring a large, leafless tree on the left, a field of tall grasses in the middle ground, and a green semi-trailer truck on the right. The foreground is a field of dry, brown crop residue. The sky is blue with light, wispy clouds.

OBRIGADO

osmar@granbio.com.br