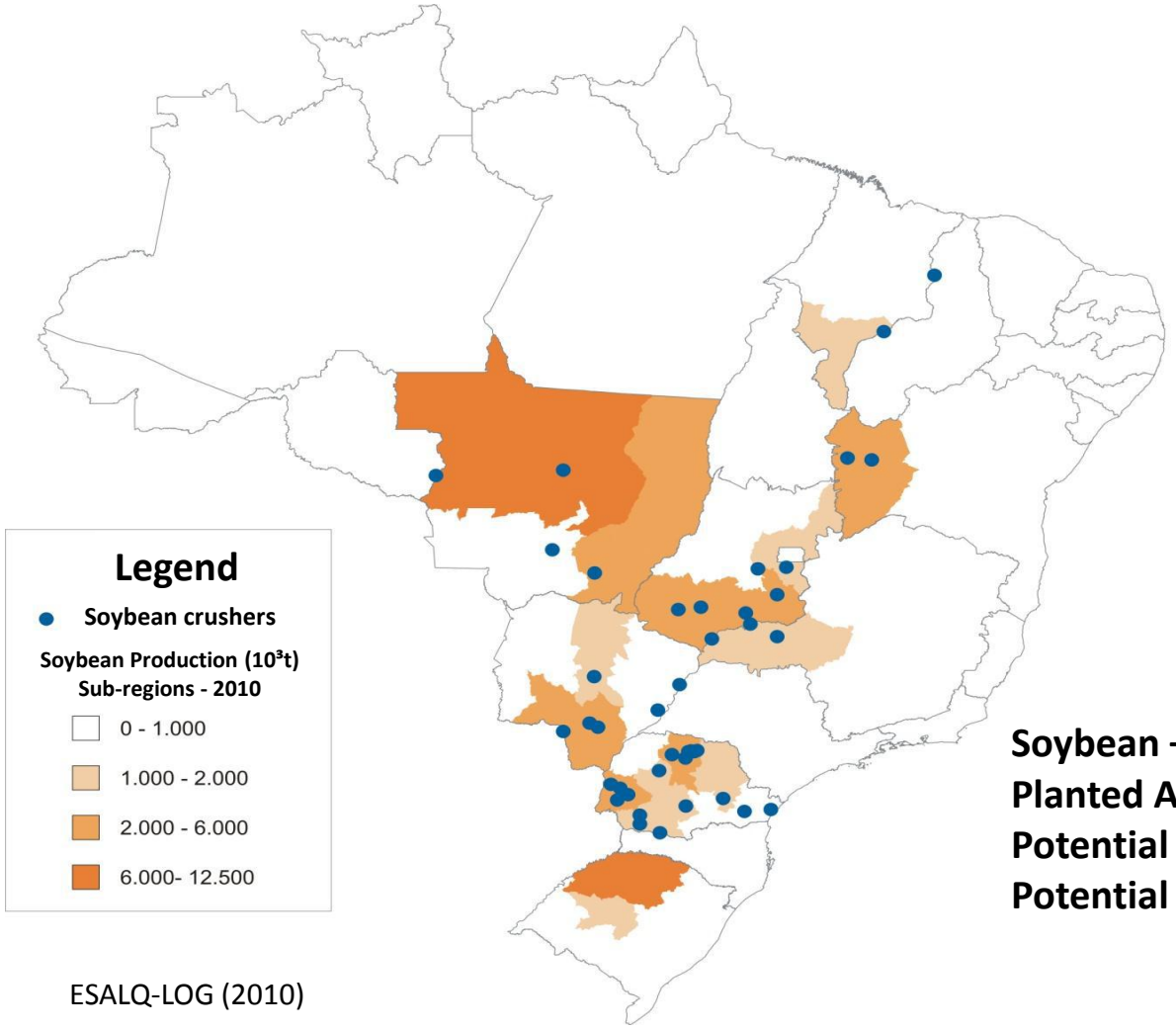
Soybean Plantations



ESALQ-LOG (2010)

2011

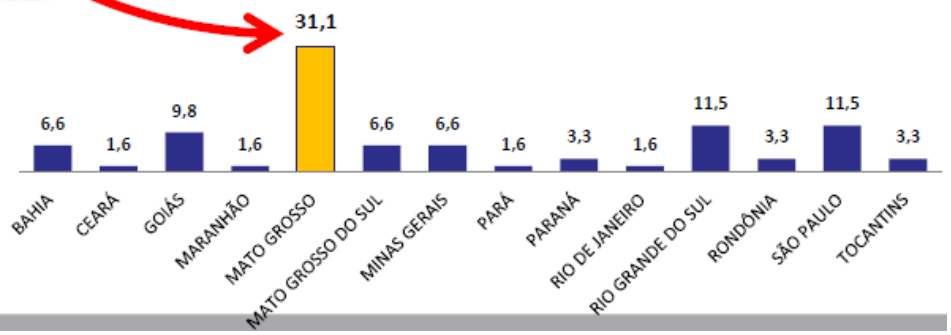
Soybean – 69 Mt
Planted Area – 25 Mha
Potential Oil – 13 Mm³
Potential Energy – 480 PJ

Biodiesel Production

Present biodiesel production would be energy sufficient to substitute 35% of jet fuel consumption

STATE	Total
BAHIA	4
CEARÁ	1
GOIÁS	6
MARANHÃO	1
MATO GROSSO	19
MATO GROSSO DO SUL	4
MINAS GERAIS	4
PARÁ	1
PARANÁ	2
RIO DE JANEIRO	1
RIO GRANDE DO SUL	7
RONDÔNIA	2
SÃO PAULO	7
TOCANTINS	2

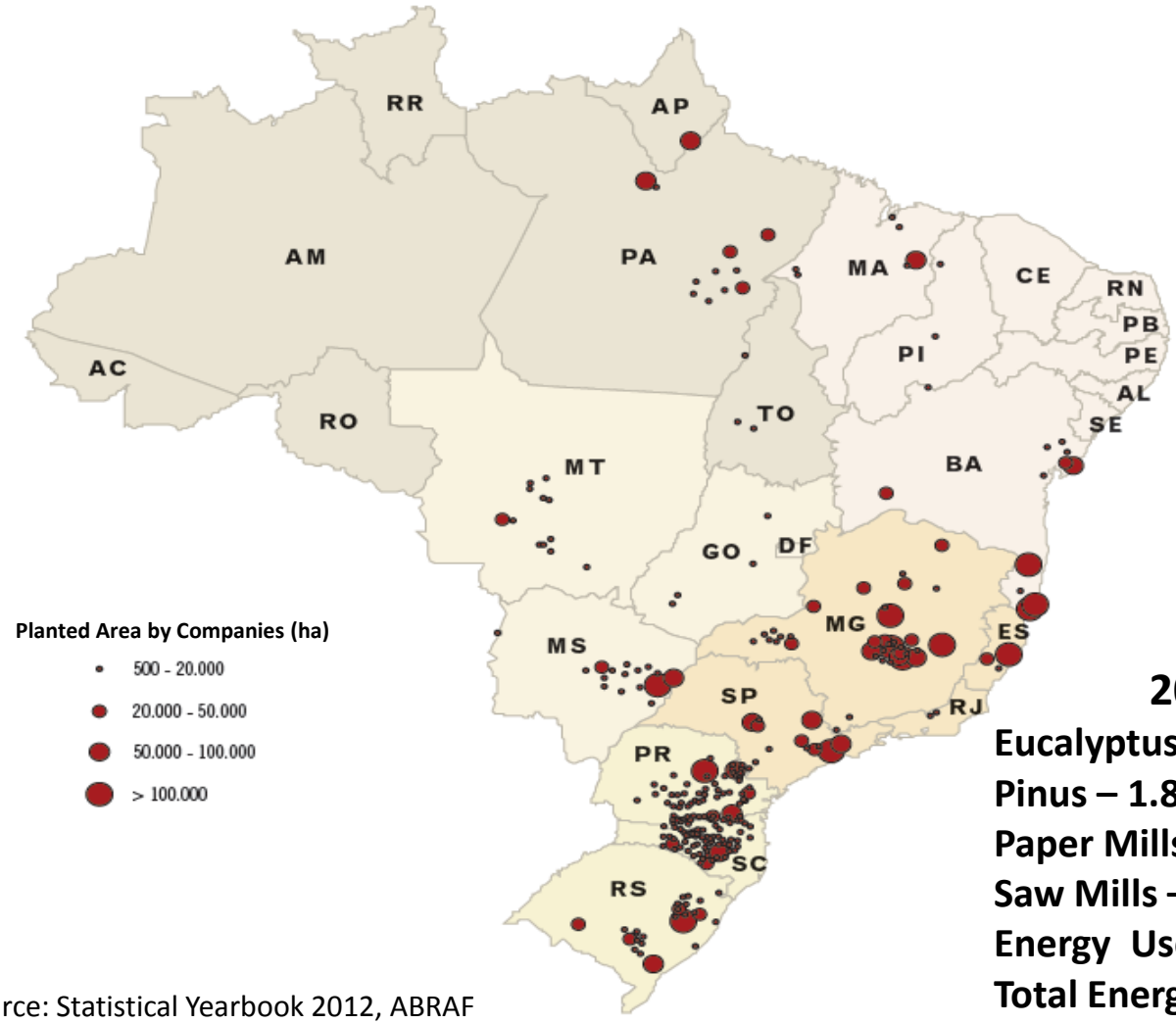
Typical Feedstock
Soybean - 80%
Tallow – 14%
Cotton seed – 3%
Other – 3%



- 64 plants
- Net production: 2,67 mil m^3
- Nominal capacity: 7,03 million m^3/year

ANP presentation

Forest Plantations



source: Statistical Yearbook 2012, ABRAF

2011

Eucalyptus – 4.7 Mha
Pinus – 1.8 Mha
Paper Mills – 45 Mm³
Saw Mills – 26 Mm³
Energy Use – 128 Mm³
Total Energy – 830 PJ

Which feedstocks to use in Brazil?

- there is no single, perfect feedstock to produce a jet biofuel in Brazil;
- a diversity of feedstocks is available for different growing conditions (eucalyptus, sugarcane, palm, camelina and jatropha) and other feedstocks with promising futures, if more R&D is implemented;
- Brazil's past experience with biofuels also shows that crops which can supply feedstock for diverse applications, for instance food, fuel, pulp, have a larger chance of success;
- considering the 2020 horizon, the most productive sources of bioenergy from the standpoints of crop yield and energy balance are sugarcane and forestry, but
- industrial wastes and municipal solid wastes represent a great potential in Brazil and therefore should be seriously considered for biofuels production.

Sustainability indicators

The sustainability assessment for the production of feedstocks in Brazil was carried out according to the principles and criteria of the currently available and most well-known international sustainability standards for biofuels production, namely Bonsucro, Roundtable on Sustainable Biomaterials (RSB) and the International Sustainability and Carbon Certification System (ISCC)

(i) Laws and International Conventions	(ii) Waste production and disposal
(iii) Land Rights	(iv) Crop Management and Agrochemical Use
(v) Employment, Wages and Labor Conditions	(vi) Direct Land Use Changes
(vii) Human Health and Safety	(viii) Social and Environmental Impact Assessment
(ix) GHG emissions	(x) Rural and Social Development
(xi) Biodiversity and Ecosystems	(xii) Contractors and Suppliers
(xiii) Soil conservation	(xiv) Engagement and Communications with Stakeholders
(xv) Water use and contamination	(xvi) Economic Viability and Production and Processing Efficiency
(xvii) Air pollution	(xviii) Food Security

Results of applying Sustainability indicators

Main positive impacts

- Social sphere: high potential for job creation, income generation and regional development;
- Environmental aspects: GHG emissions reductions compared to fossil fuels

Gaps for compliance with sustainability requirements

- Great number of laws and rules, sometimes stricter than sustainability standards;
- Different interpretations and lack of knowledge on how to apply laws;
- Uneven enforcement and certain labor laws not adapted to the rural context;
- Need for qualification and training of workers.

Why indirect effects of agriculture is low in Brazil

ILUC and food versus fuel are the two most relevant indirect effects raised as concerns in the biofuels debate.

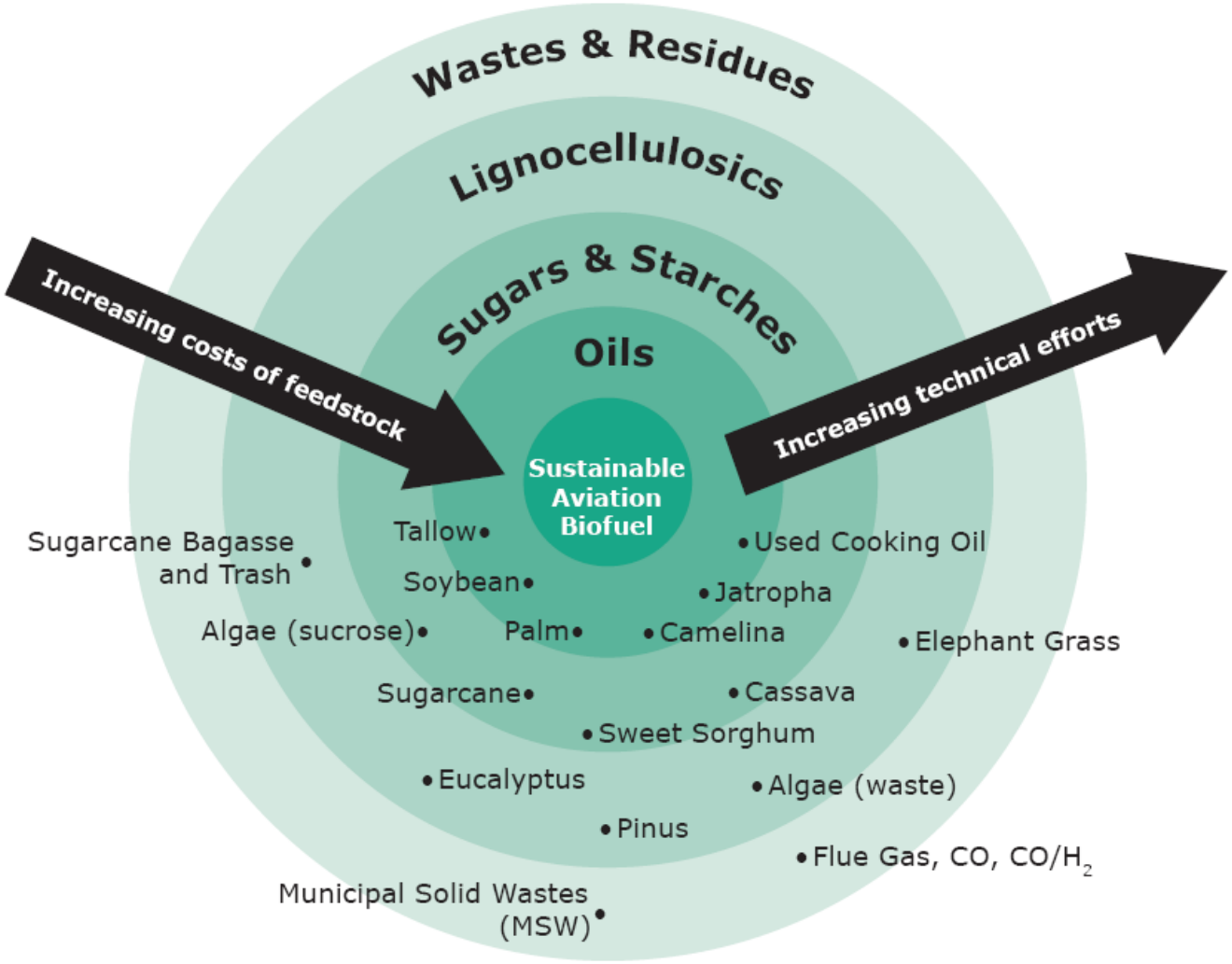
- process of intensification and efficiency gains with increasing yields in crops and livestock;
- a lot of space for intensifying cattle production in Brazil;
- Brazil has developed a double-cropping system;
- The reality in Brazil shows a food-and-fuel situation rather than food-versus-fuel;
- the cultivation of oilseeds in rotation with sugarcane is also generating food and fuel in the same systems;
- deforestation has been reduced since 2004.

Conversion and Refining Process

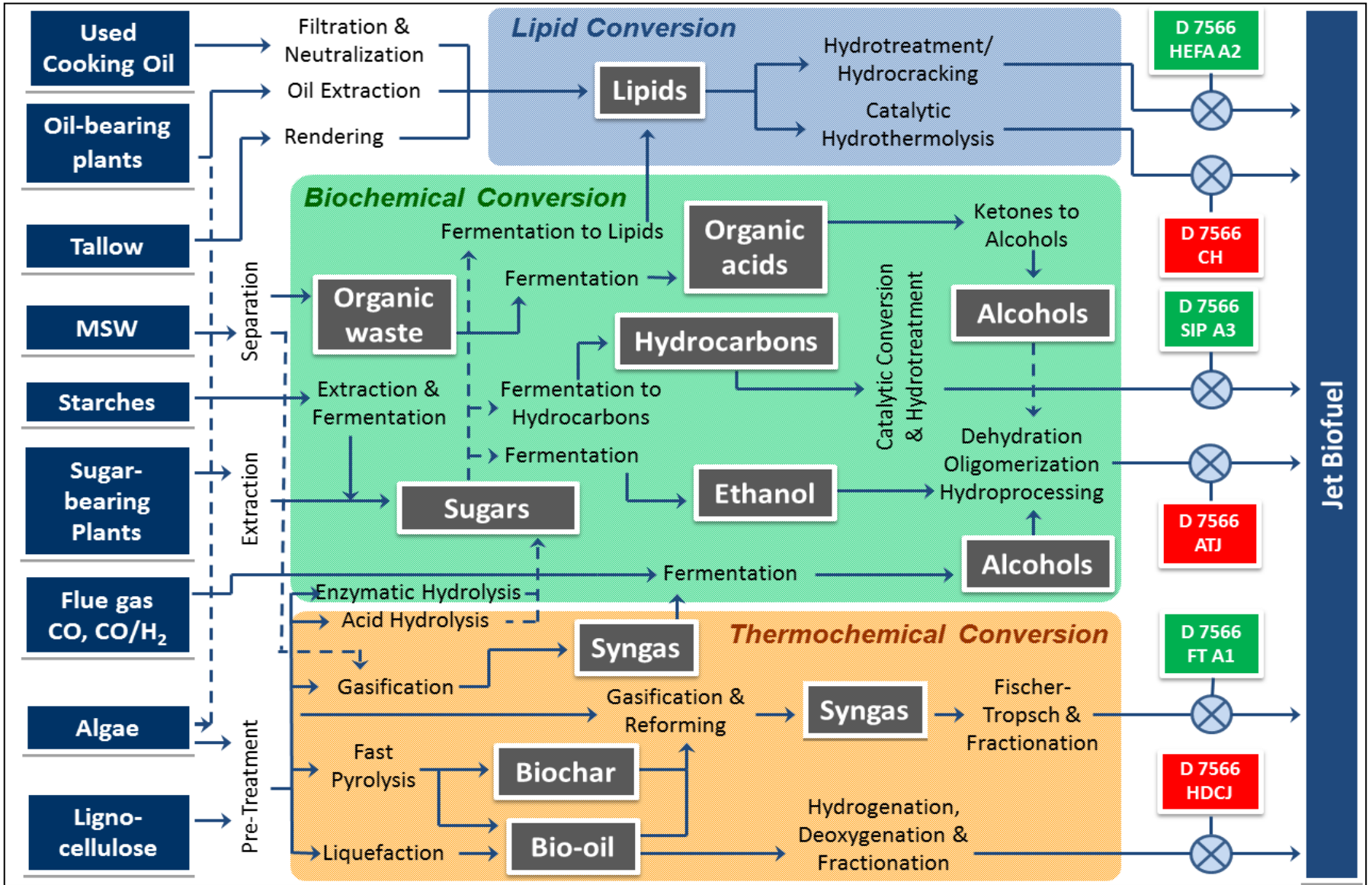
Range of conversion and refining technologies evaluated in the Workshops:

- Gasification
- Fast pyrolysis
- Solvent liquefaction
- Enzymatic hydrolysis of cellulosic and lignocellulosic biomass;
- Alcohol oligomerization to jet fuel (ATJ);
- Hydroprocessing of esters and fatty acids (HEFA);
- Fermentation of sugars and wastes to alcohols, to hydrocarbons (DSHC), and to lipids.

Feedstocks & Processes

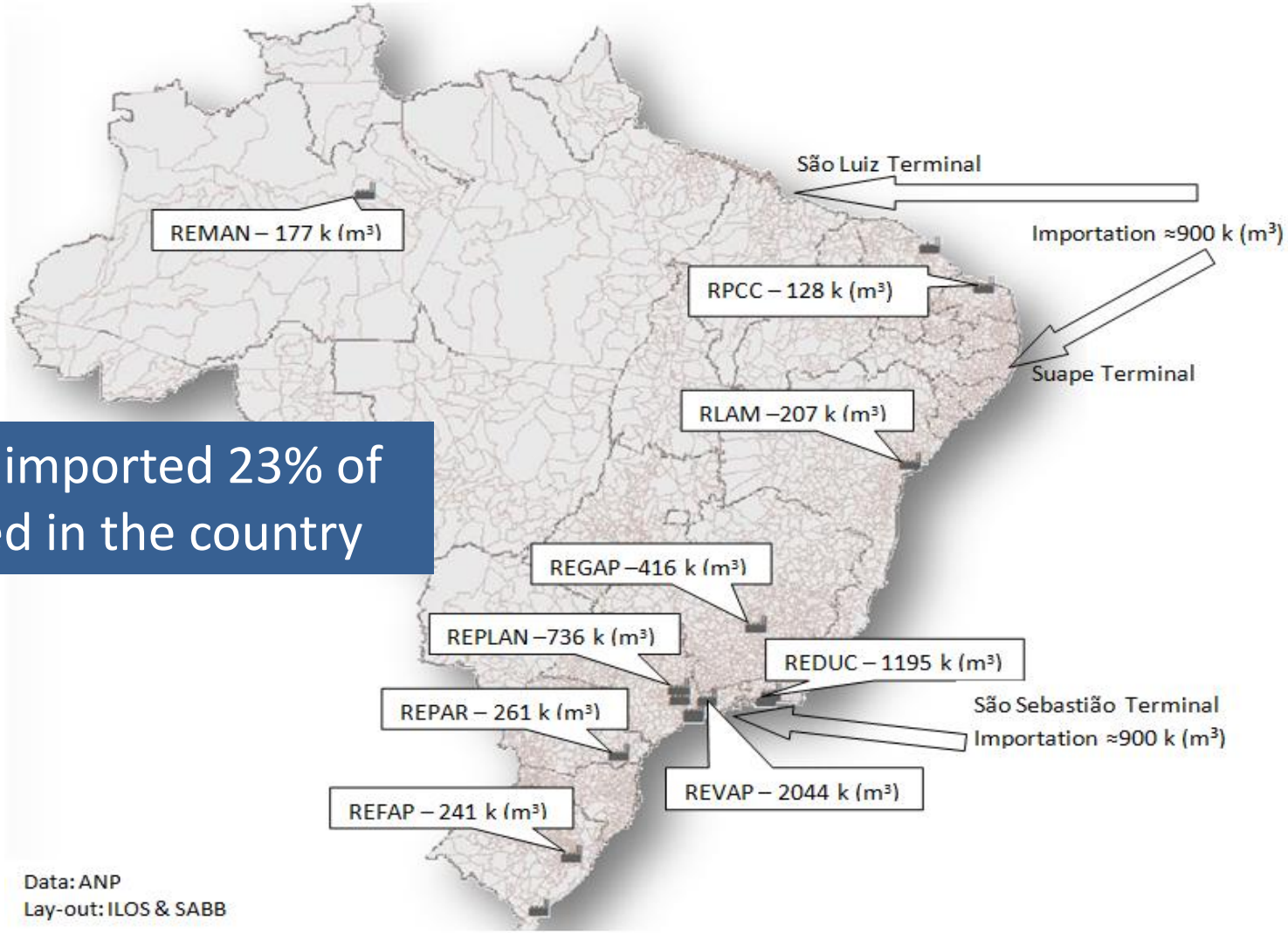


Identified Pathways



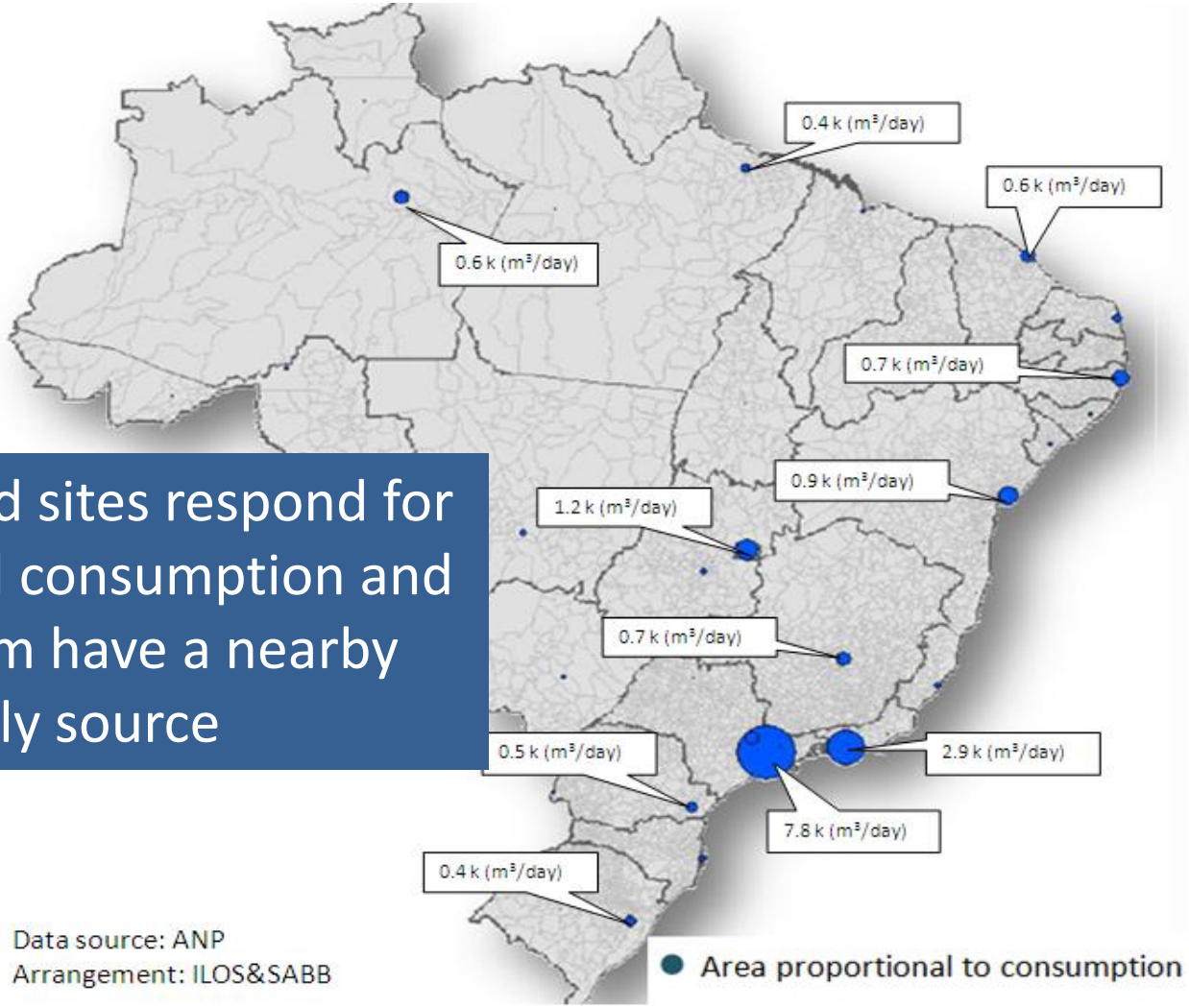
Jet Fuel Production

In 2011 Brazil imported 23% of jet fuel tanked in the country



Jet Fuel Consumption

The pinpointed sites respond for 88% of jet fuel consumption and most of them have a nearby supply source



Logistics of Jet Fuel

The main conclusions about logistics were:

- regional airports located close to feedstock production fields may benefit from a different logistics of the one applied to fossil fuels, feature that will have to be considered in the implementation of a national policy promoting jet biofuel;
- by adopting the international concept of “drop-in” jet biofuel, the essential anticipated barriers for the distribution logistics of jet biofuels are surpassed;
- some commercialization gaps and barriers remain, mainly in the logistics of the biofuel before the blending point and with the establishment of technical and legal requirements the “blender” will have to fulfill;
- the best alternative for finishing the biofuel, preparing the blend and issuing a certificate of quality for the batch of jet biofuel is a terminal nearby the airports and suppliers;
- the logistics of the jet biofuel production deserves detailed studies for each type of feedstock and applied processes to maximize economic benefits.

Economical Gaps and Actions

- develop logistic studies for investment on railways and waterways taking into account feedstocks for biofuels in general and jet fuel specifically;
- make sure that the cost advantage of Brazilian agriculture products in international markets is reflected in aviation biofuels production similarly to other biofuels;
- take actions to ensure that the cost difference of aviation biofuel to conventional fuel in Brazil is smaller than in other countries, in a way that the possible exportation of jet biofuel through international flights can enable the competitiveness of the aviation biofuels industry established in the country.

Conclusions and Recommendations

Which R&D efforts are necessary?

(mainly)

- improve agricultural productivity of identified feedstocks;
- improve energy efficiency of processing technologies;
- study the best location and foster the construction of demonstration and pioneer commercial for jet biofuel production ;
- consolidate the competence for testing and certification of jet biofuel.

Which infrastructure and regulatory actions are needed in Brazil?

- develop logistic studies for feedstocks and jet fuel specifically;
- evaluate and take actions to assure the competitiveness of jet biofuel with regards to conventional fuel in Brazil and abroad;
- prepare the set of regulations on jet fuels to accept biofuels according to ASTM guidelines;
- establish the “drop-in” sites in the distribution to assure fuel quality and technical certification .

Conclusions and Recommendations

Main specific policy recommendations

- *promote the development of human resources on jet biofuels technology;*
- *promote LCA studies on crops with bioenergy potential;*
- *develop assessment on residues availability and collection;*
- *support (financing) for pilot and demonstration plants;*
- *evaluate infrastructure needs of regions with potential for biofuel production;*
- *consolidate the sustainability certification process of jet biofuels*
- *establish a governmental long-term program, with a clear agenda of strategic actions;*
- *promote information campaign on potential, benefits and implications of jet biofuels.*

Conclusions and Recommendations

The effective introduction of sustainable jet biofuels means a very important opportunity for developing the aeronautic sector and the agroindustry, beneficial for the society and the environment.

Brazil has an excellent position to become a global player.

There are challenges to overcome to create this new industry, but Brazil has resources to face them and cannot afford not to participate.

THANK YOU FOR YOUR ATTENTION

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