

Alternative Fuels for Aviation in Brazil

Introduction and Global Context

&

Overview of HCD modules

Por ordem do



Ministério Federal
do Meio Ambiente, Proteção da Natureza
e Segurança Nuclear

da República Federal da Alemanha

Por meio da:

giz

Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH



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EMPREENDEDORISMO
E INOVAÇÃO

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**PÁTRIA AMADA
BRASIL**
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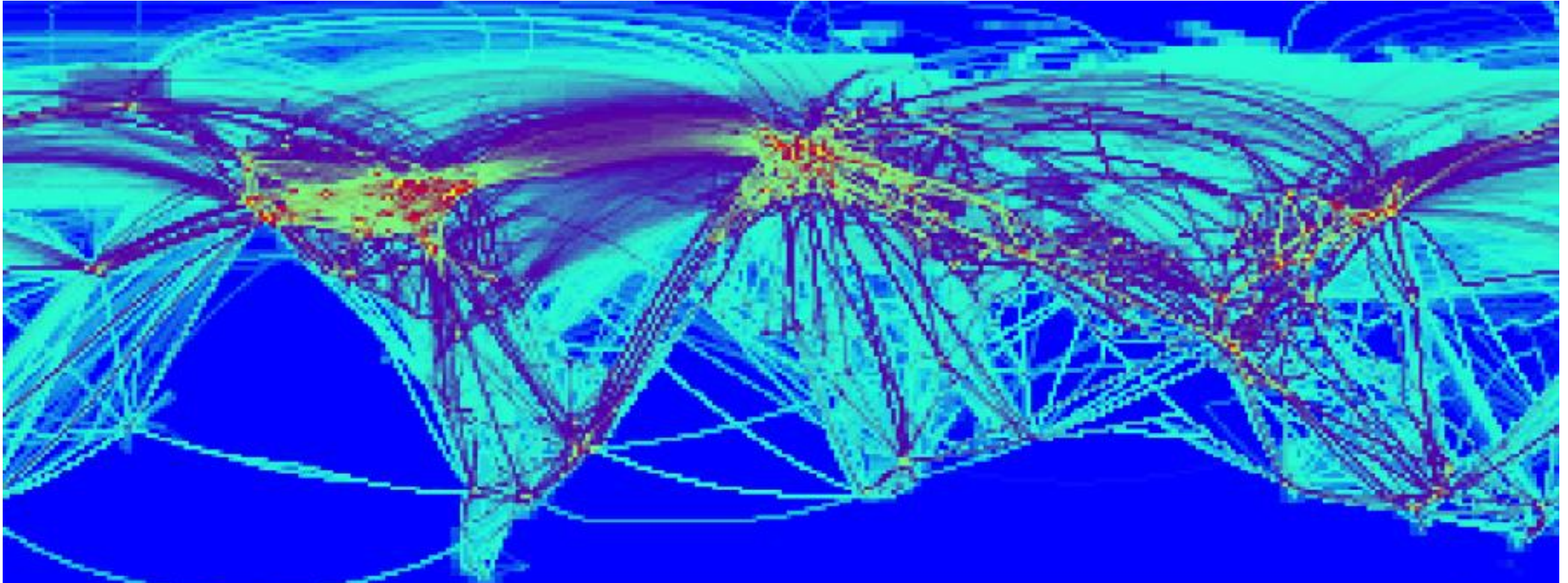
Nations Unies

Paris Agreement COP21 UNFCCC 2015

- Article 2 .1 (...) aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:
 - (a) **Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, (...);**
 - (b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, (...)
 - (c) Making finance flows (...)
- Article 4.1 (...) aim to **reach global peaking of greenhouse gas emissions as soon as possible, (...)** , so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century, (...)
- **Aviation must make its contribution to achieving international climate target**

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Emission of Aviation – Global Distribution



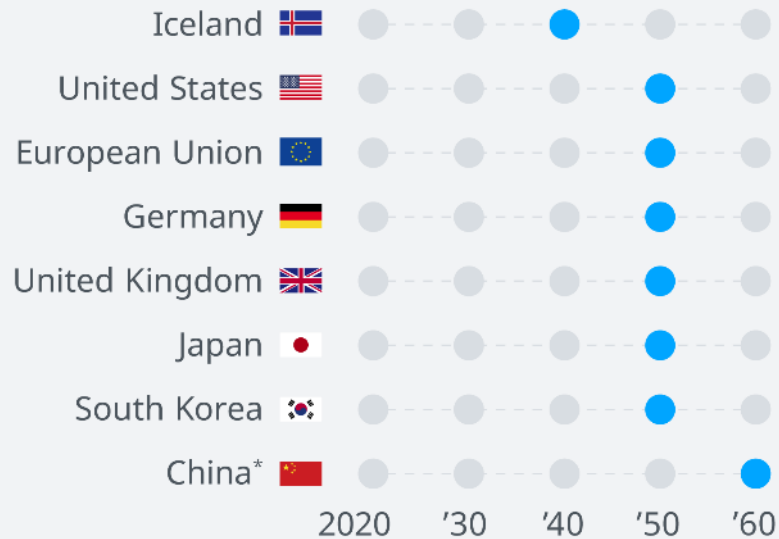
Aviation Fuel: 169 - 213 Tg/a (about 2 % of all CO₂-emissions)
NO_x: 2.6 -3 Tg(NO₂)/a (about 1.5 % of all NO_x-emissions)

Climate and Aviation: the conflict

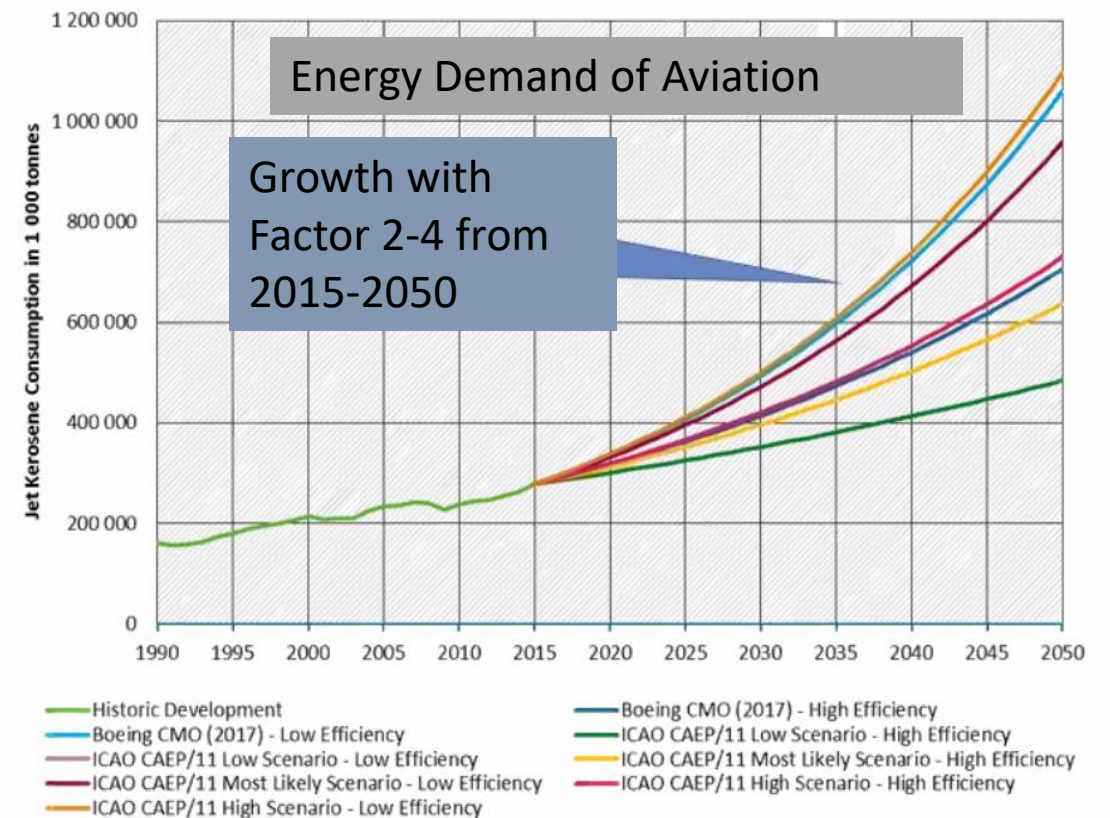


Global Climate-neutral Targets

By when have countries committed to net zero greenhouse gas emissions?



Energy Demand of Aviation

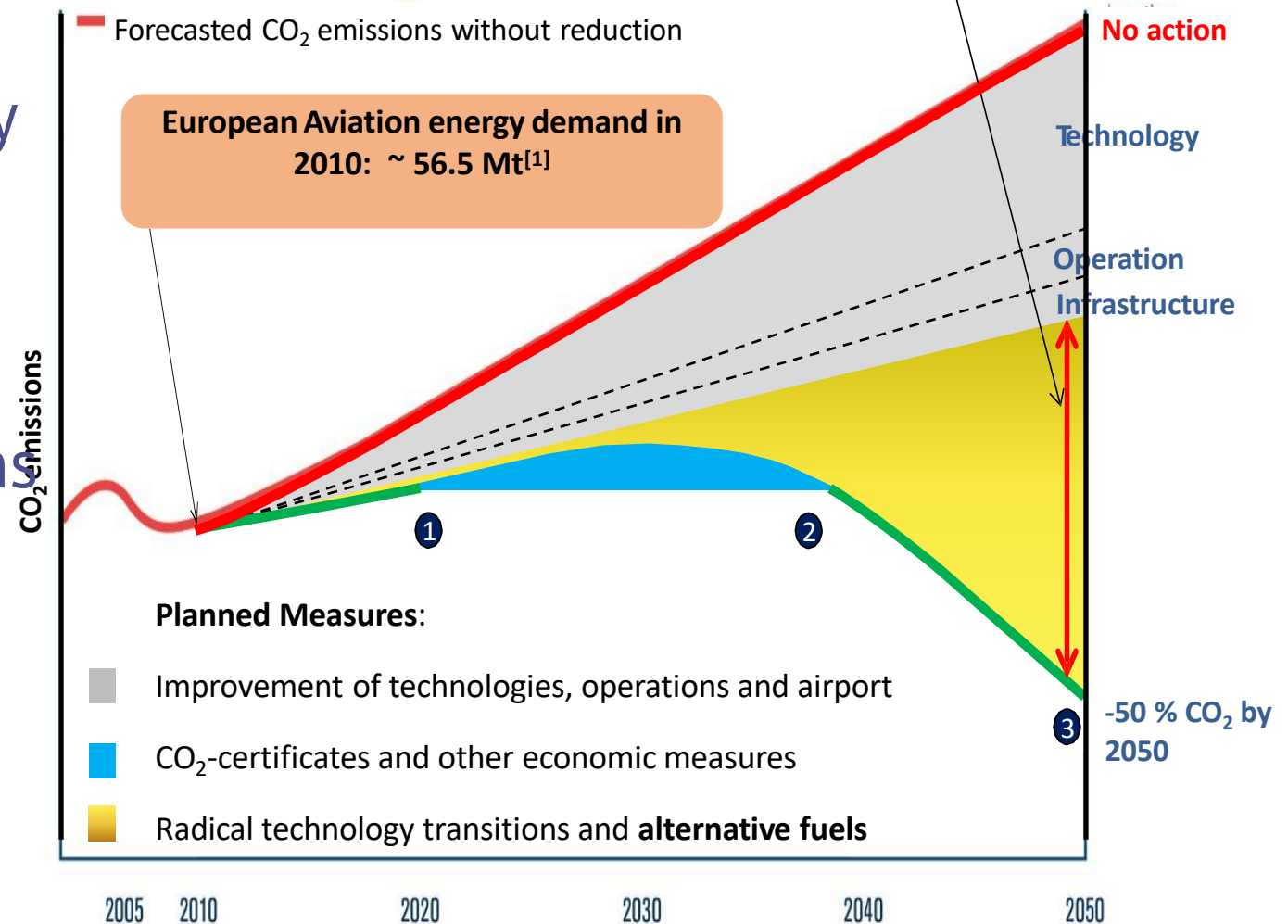


<https://www.dw.com/en/joe-bidens-climate-pledges-are-they-realistic/a-56173821>

IATA Technology Roadmap

Main aims:

- Improvement of fuel efficiency about 1,5 % p.a. until 2020
- Carbon-neutral growth from 2020
- 50 % CO₂ emissions reduction by 2050



Approaches to reduce emissions



Technology

- Efficiency
 - Technical improvements, ongoing
 - Fleet renewal
 - Flight route optimization (SES+)
- Alternative Fuels
 - only green/from renewable energy
 - Biomass or electricity based
- Alternative Propulsion
 - Hydrogen
 - E-Flight

Economy

- Taxation
 - Kerosene tax
 - VAT
 - Ticket charges
- Carbon taxing
 - EU Emission Trading (ETS)
 - CORSIA
 -
- voluntary compensation
 - AtmosFair, ...

Activities for Alternative Fuels



■ International / Global

- **ICAO Vision SAF 2050** / CAAF/2
- ICAO Environmental Committee > SAF working groups
- ICAO Global Framework for Aviation and Alternative Fuels (GFAAF)

www.icao.int/environmental-protection

www.icao.int/environmental-protection/SAF

■ Europe

- **European Green Deal: Action Plan**
- EU Hydrogen Strategy
- ReFuelEU Aviation

ec.europa.eu/info/files/annex-roadmap-and-key-actions_de

ec.europa.eu/energy/topics/energy-system-integration/hydrogen_en

■ National Level Germany

- Climate Action Plan 2050 / Program 2030 > BMU
- **National Hydrogen Strategy 2050** > BMWI/BMBF
- Several program and action to develop climate-neutral Sustainable Aviation Fuels (SAF)

www.bmu.de/.../greenhouse-gas-neutral-germany-2050/

www.bmwi.de/.../die-nationale-wasserstoffstrategie.html

■ National Level Brazil

- ANAC: Brazil Action Plan for CO₂ reduction in Aviation to ICAO (2013)
- RBQAV. A Rede Brasileira de Bioquerosene de Aviação (RBQAV)

www.anac.gov.br

www.rbqav.com.br

Technological Routes – Certification (ASTM)

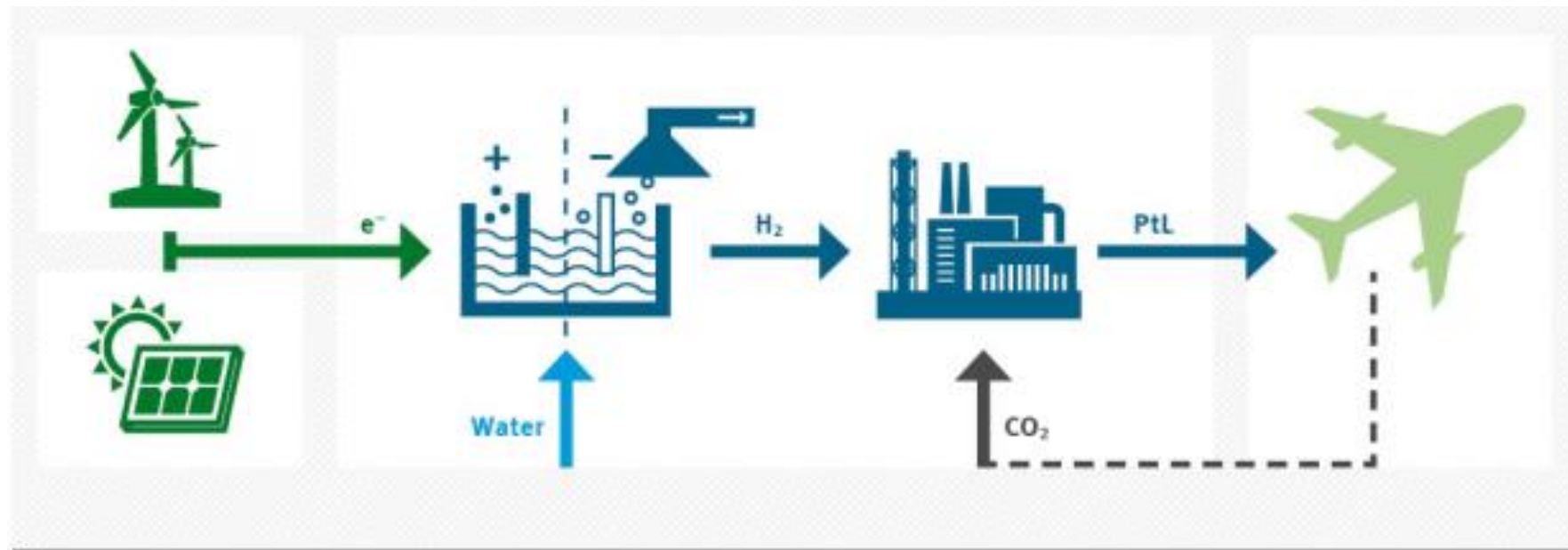
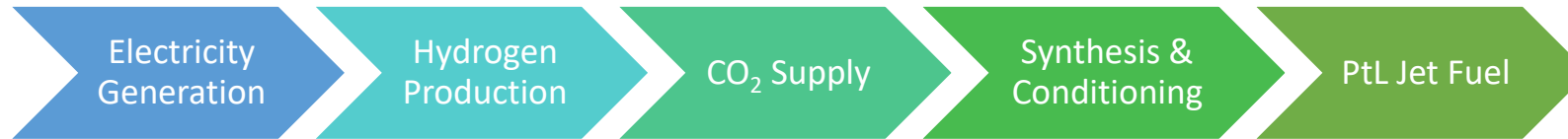


Certification	Input	Product	Drop-in
D 1655	 	Jet A-1	100 %
D 7566 Annex IV	  	Fischer-Tropsch with Aromates (FT-SKA)	50 %
D 7566 Annex I	  	Fischer-Tropsch (FT-SPK)	
D 7566 Annex II	 	Hydro-proc. Esters and Fatty Acids (HEFA)	
D 7566 Annex V	 	Alcohol/Ethanol	<50 %
D 7566 Annex III	 	Synthetic Iso-Paraffine (SIP)	10 %



Hydrogen as the key to PtL

Power-to-Liquid (generic scheme)



Source: LBST

Source: German Environment Agency / Umweltbundesamt (UBA): Power-to-Liquids: Potentials and Perspectives for the Future Supply of Renewable Aviation Fuel , Sept 2016



The HCD concept: Train-the-trainer

Overview of modules



Overview of available modules



0. Introduction on ProQR – Project and Global Context	DLR-VE ESY	GIZ
1. Brazil - Infrastructure and Future energy strategies	DLR-VE ESY	GIZ
2. Renewable Energy Potential	DLR-VE ESY	ANEEL
3. Feedstocks for PtL (Water and CO ₂)	DLR-VE ESY	UFRJ
4. Electrolysis & Syngas production	DLR-VE ESY	Hytron
5. Synthesis	DLR-VE ESY	UFPR
6. Post-Processing (Refinery)	DLR-VE ESY	UFRJ
7. Certification	DLR-VT	ANP
8. Engineering, Procurement, Construction (EPC)	ENOLCON	DLR/Hytron
9. Operation & Maintenance (O&M), End of Life	ENOLCON	DLR/ISI-ER
10. Products	DLR-VT	ANP
11. Energy Planning	DLR-VE ESY	EPE
	prepared by...	with support...

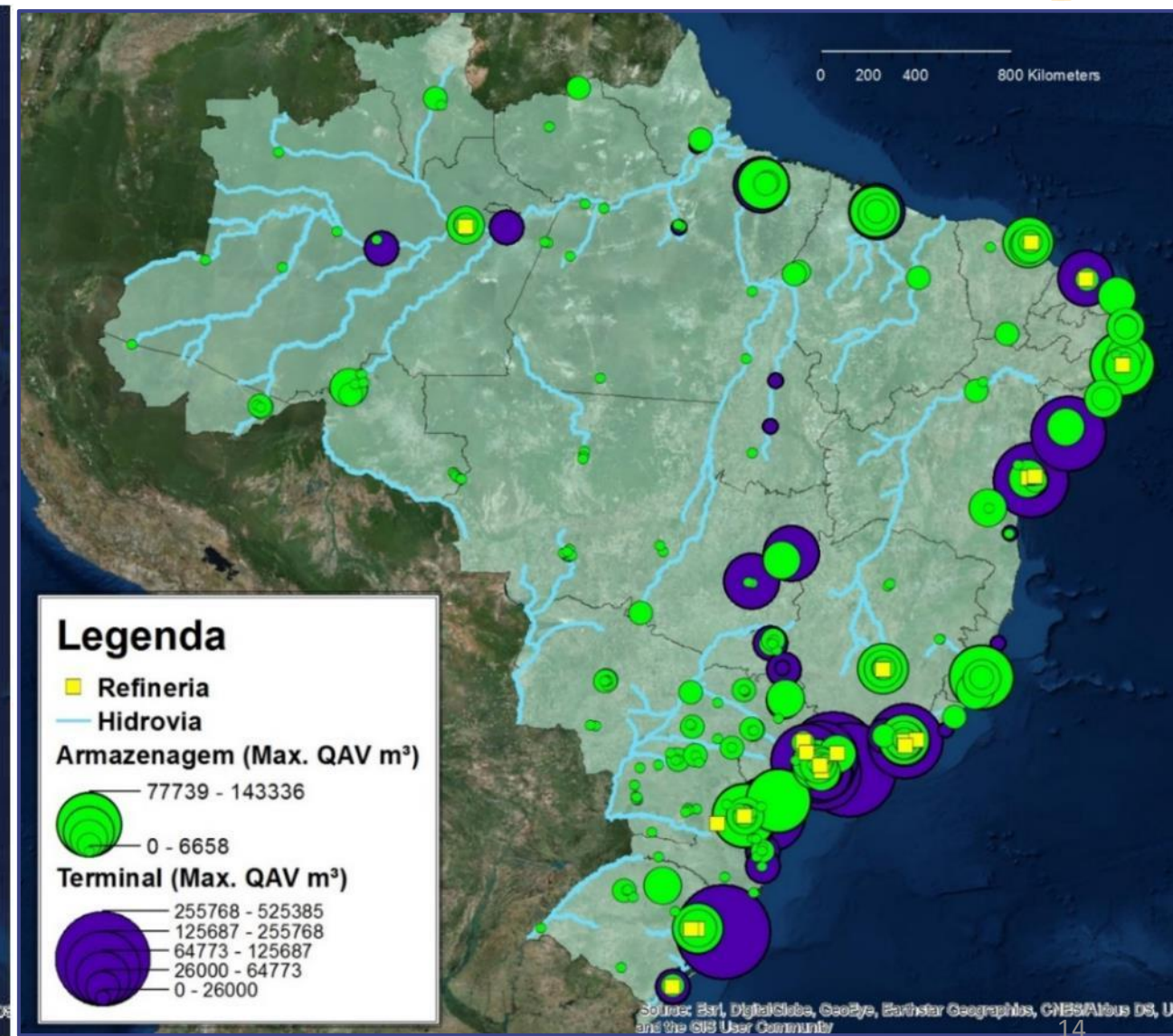
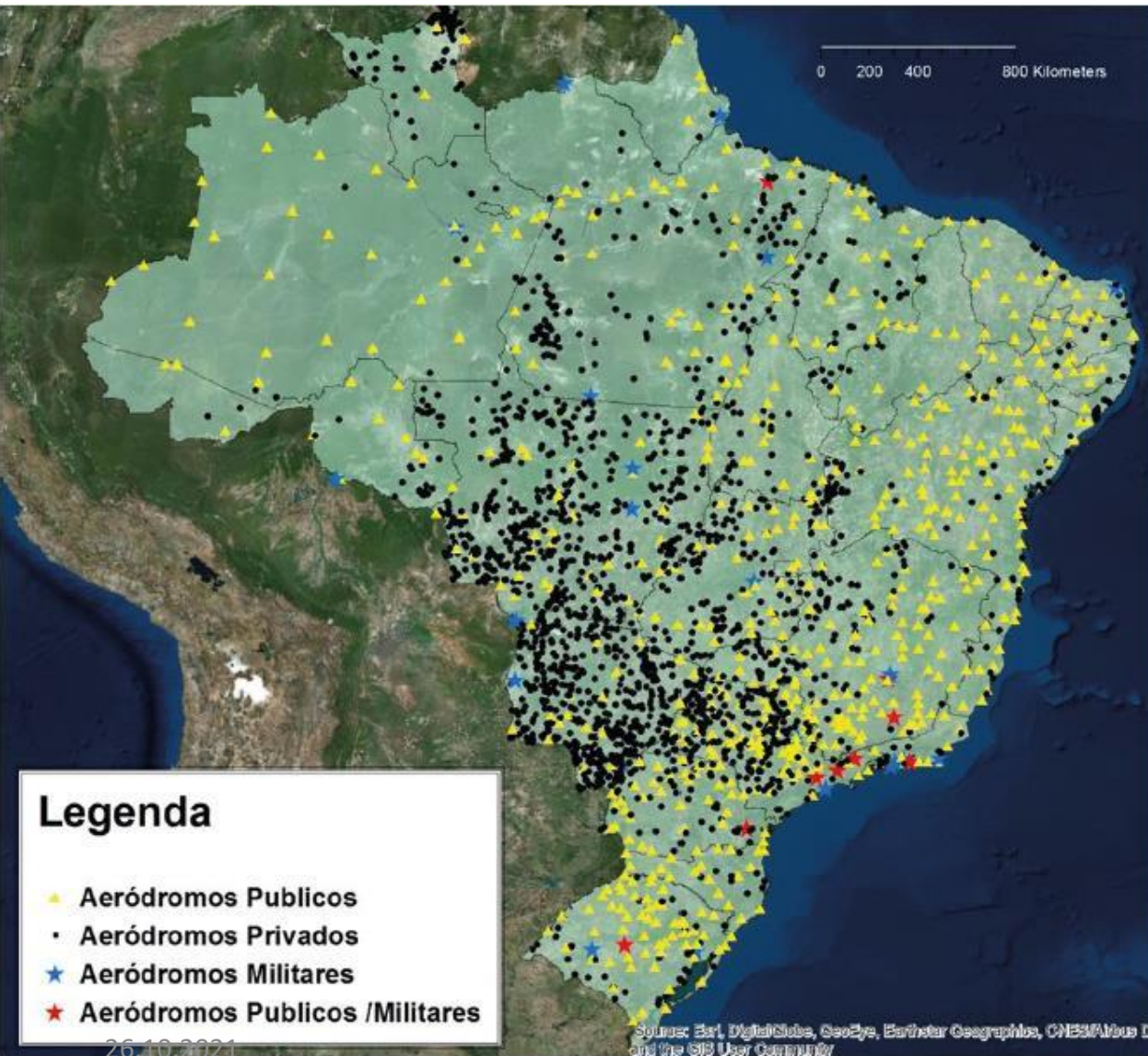


The ProQR vision and approach

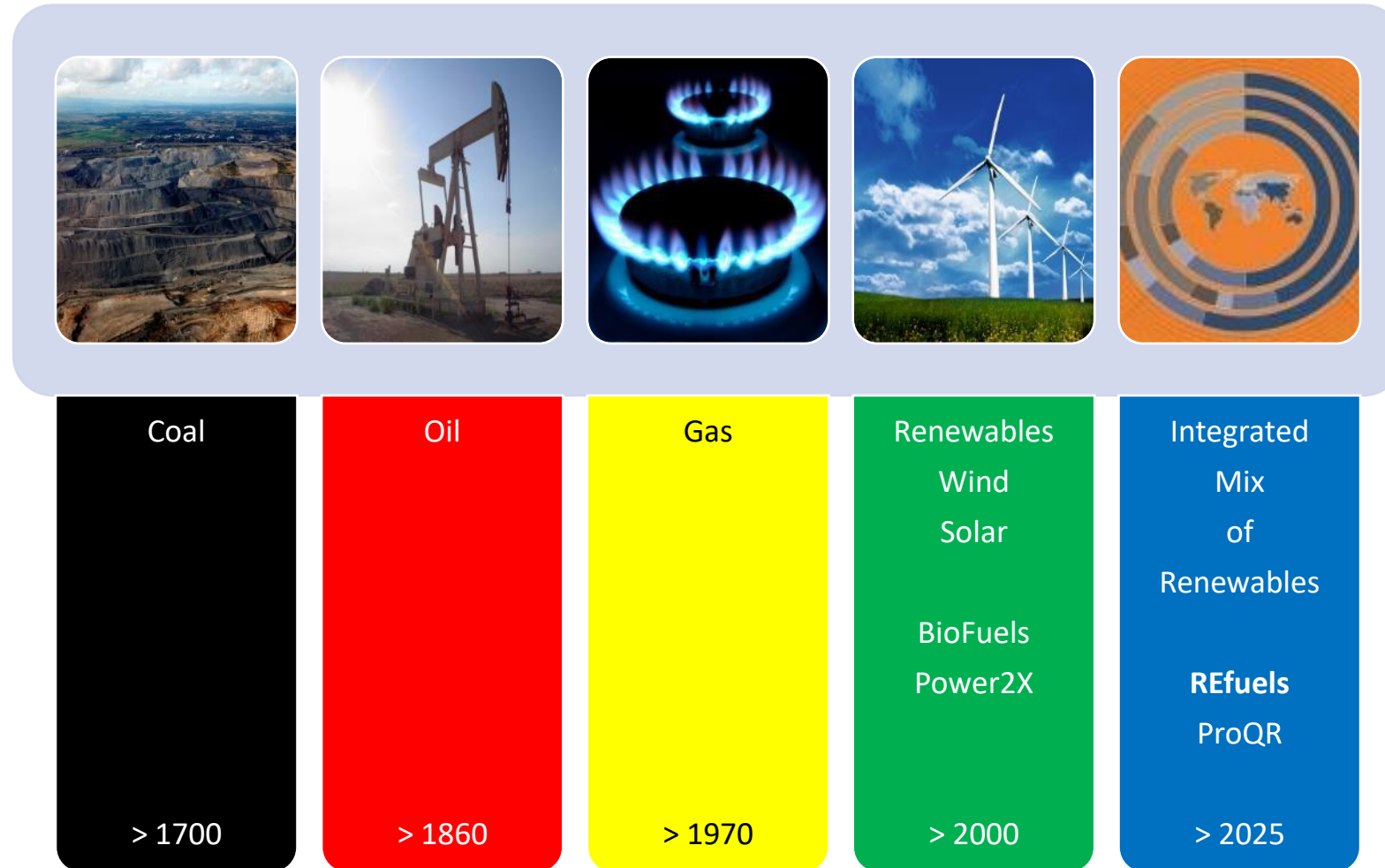
Concept and Benefits



Brazil's niche opportunity – decentralized



Vision: REfuels >>> Mission: ProQR



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