Advanced biofuels – what holds them back?

IRENA
International Renewable Energy Agency

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About IRENA

Established in 2011.

160+ Members
23 States in accession.

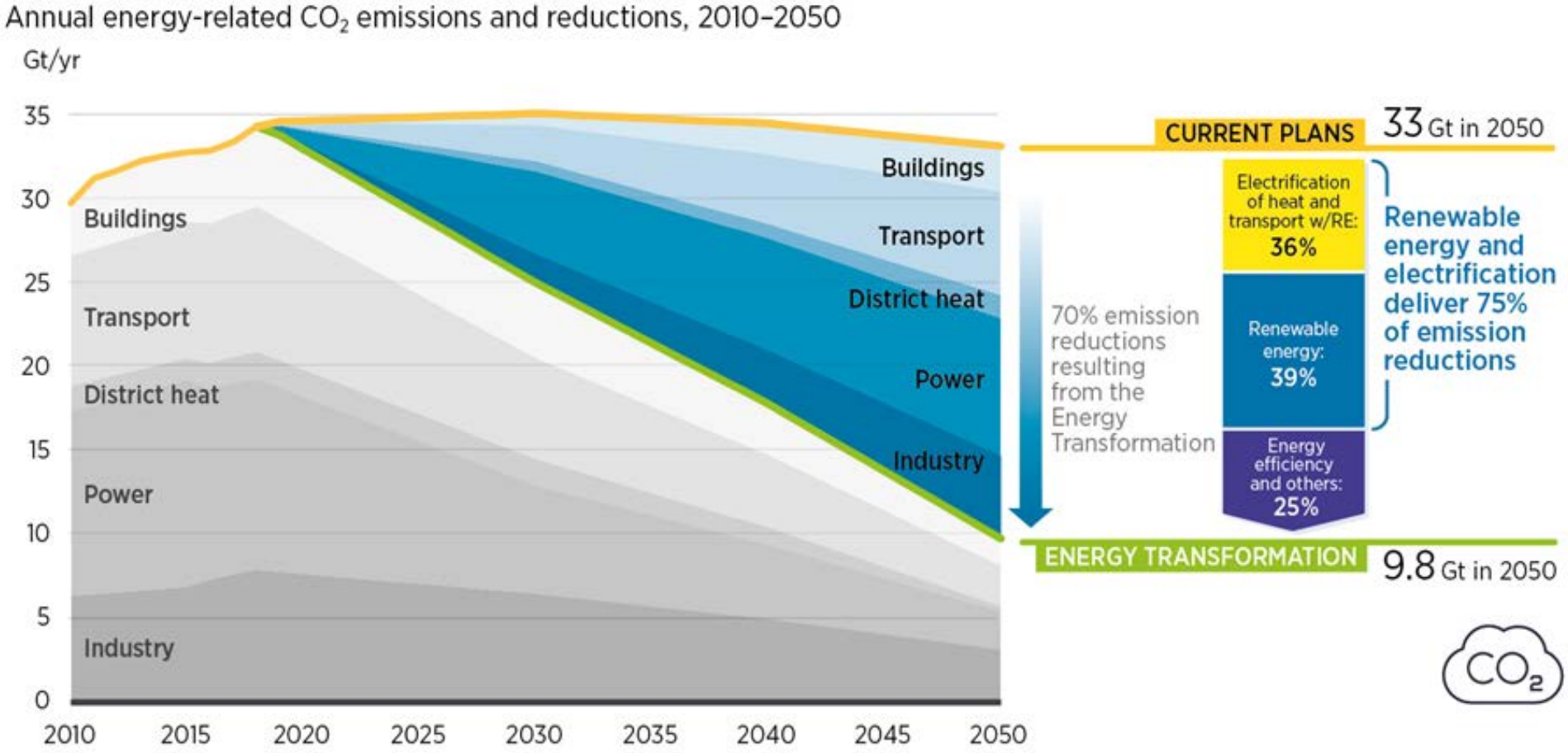
Mandate: to promote the **widespread adoption and sustainable use of all forms of renewable energy**

Scope: All renewable energy sources produced in a **sustainable manner**

IRENA serves as:

- Centre of excellence for knowledge and innovation
- Global voice of renewables
- Network hub
- Source of advice and support

Renewables, electrification and energy efficiency can deliver over 90% CO_2 emission reductions needed to achieve Paris Climate goals



RE in TPES: 27%

RE in TPES: 65%

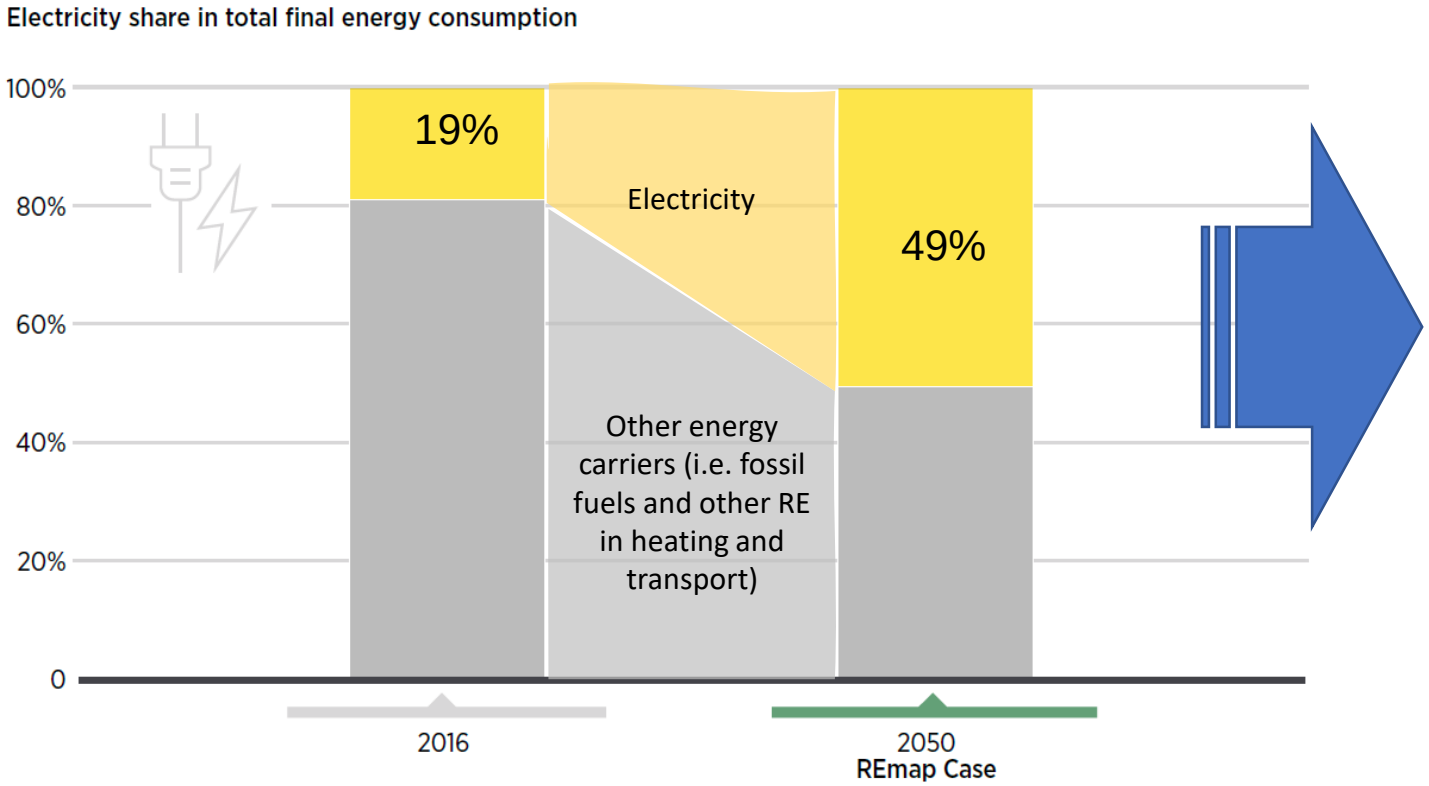
IRENA's upcoming flagship report – **Global Renewables Outlook (2020 edition)** to be available online on 24th March 2020.

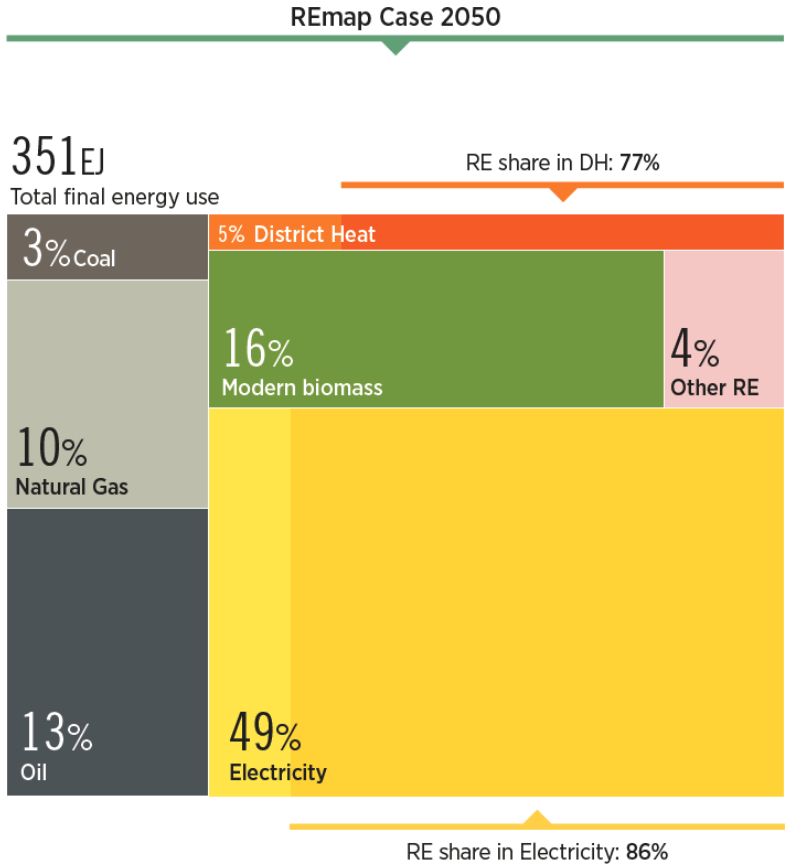
https://www.irena.org/publications

Source: IRENA Global Energy Transformation (2019)

Electrification paired with renewables is a major solution for decarbonisation

Electrification with renewable power is immediately deployable, affordable and with significant socio-economic benefits





Source: IRENA Global Energy Transformation: A roadmap to 2050 (2019 edition)

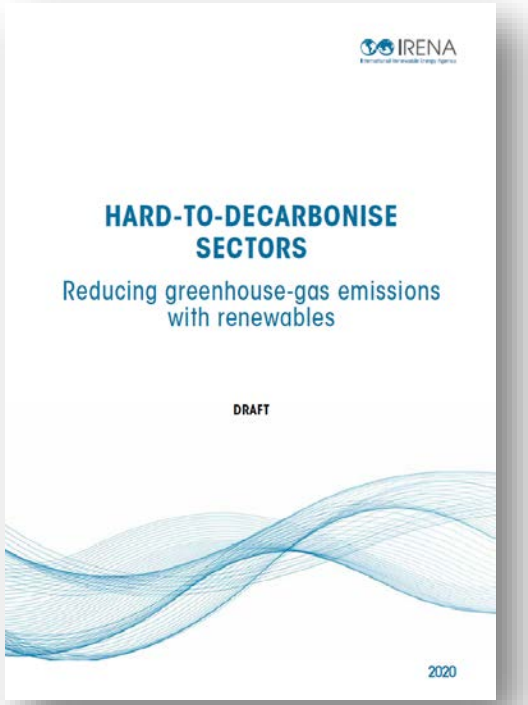
- The share of electricity in energy use increases to ~50% by 2050
- 51% non-electric energy left – about 175 EJ
- 1,700 GW of electrolysers capacity
- Electricity consumption more than doubles by 2050
- 8% of electricity – 4,400 TWh – is used for producing hydrogen

Hard-to-decarbonise sectors (HTDS)

The power sector is making progress

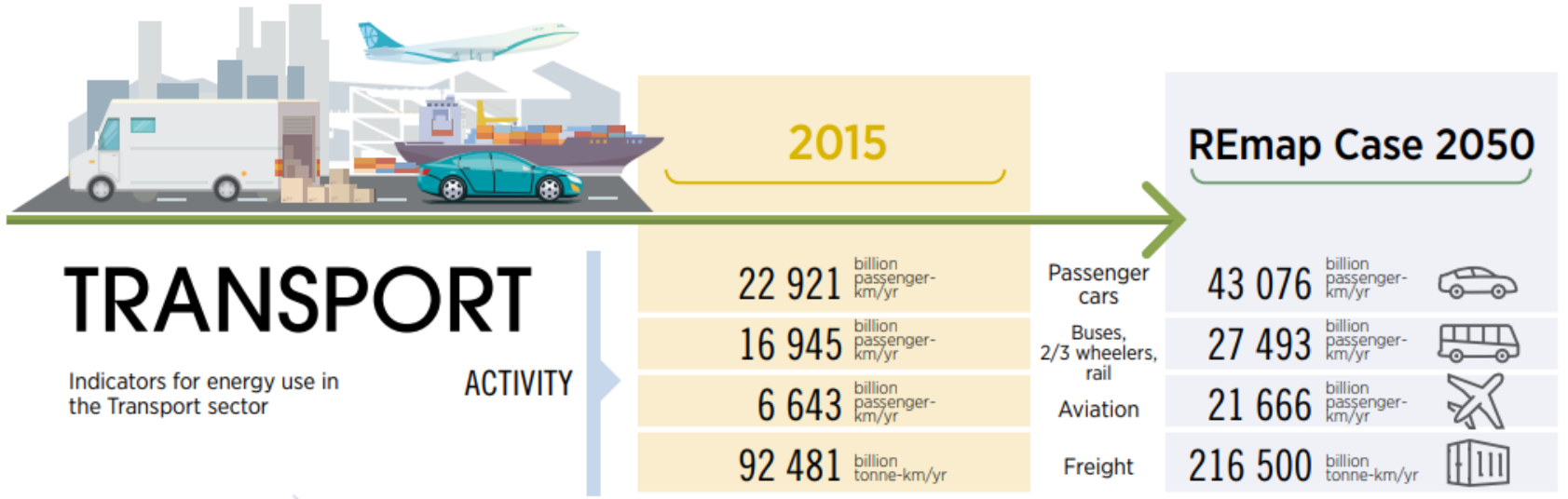
Challenges to decarbonisation

- Energy-intensive industries:
  - Iron and steel making
  - Chemical and petrochemical production
  - Cement making
  - Aluminum making
- Transport except light vehicle fleets
  - Airplanes
  - Marine ships
  - Heavy long-distance freight trucks



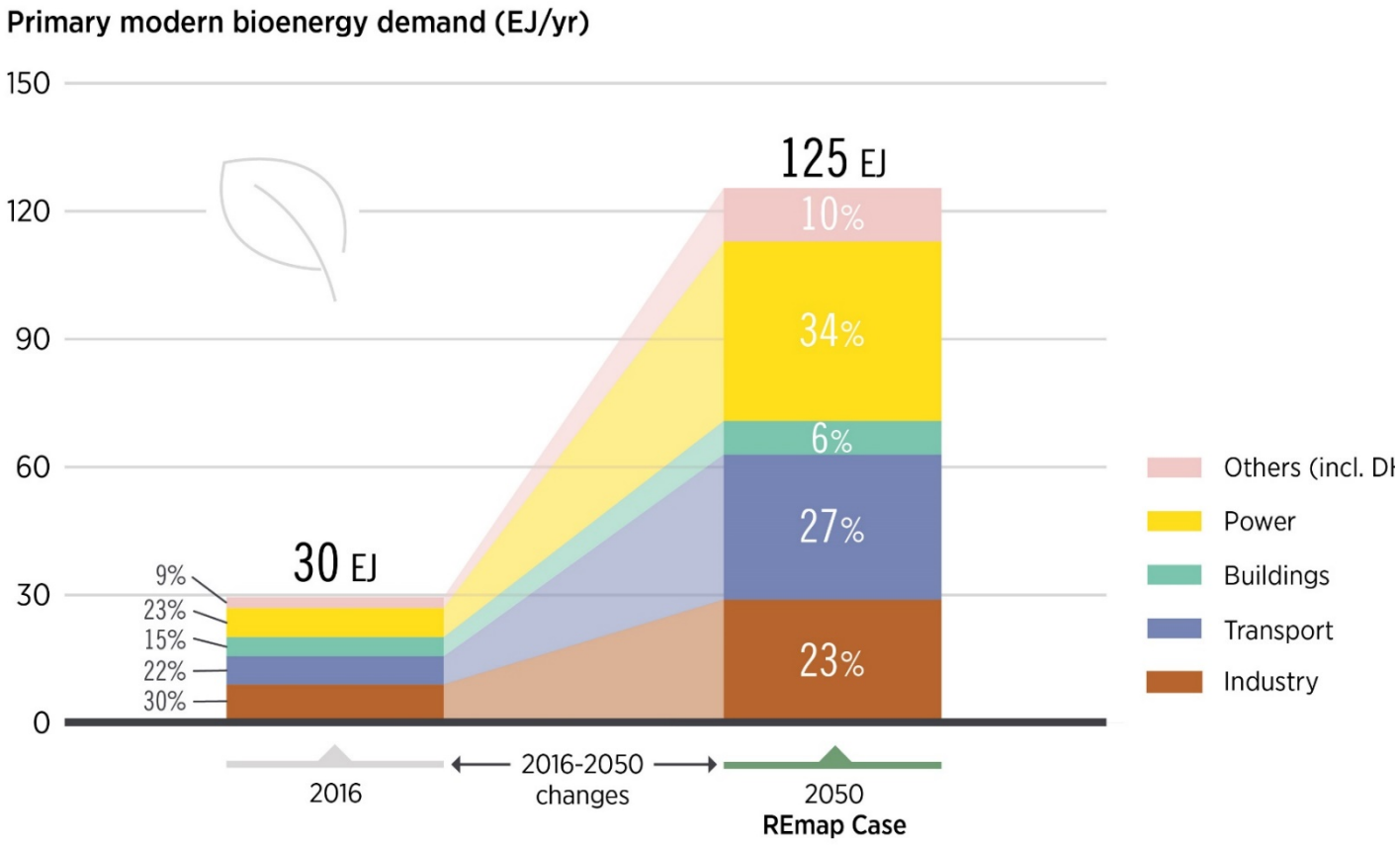
Forthcoming (2020)

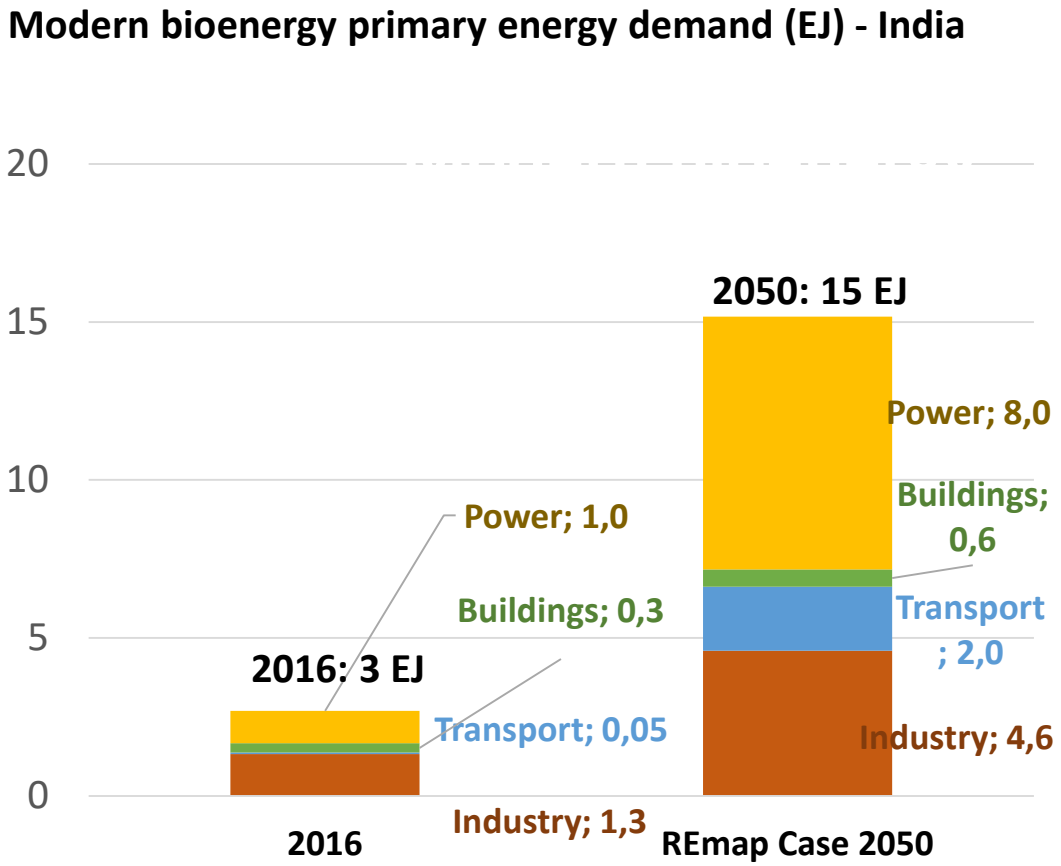
Transport sector – future demand growth – Maybe only in speaking



- **Global transport passenger activity would almost double by 2050 compared to current levels.**
- **Globally, passenger aviation activity will more than triple even in a climate friendly scenario (REmap).**
  - » **For India, domestic passenger activity would grow six-fold by 2050 (REmap) compared to 2017 levels.**
- **Energy intensity** differs by mode:
  - Cars 1.0-3.5 MJ/p-km (average 2.1), aviation 1.0-2.9 (average 1.75), bus 0.6, two-three wheeler 0.5, rail 0.3
  - Trucks 0.7-2.0 MJ/t-km, rail 0.4, shipping 0.3

Modern bioenergy should be deployed more than four times larger than the current level

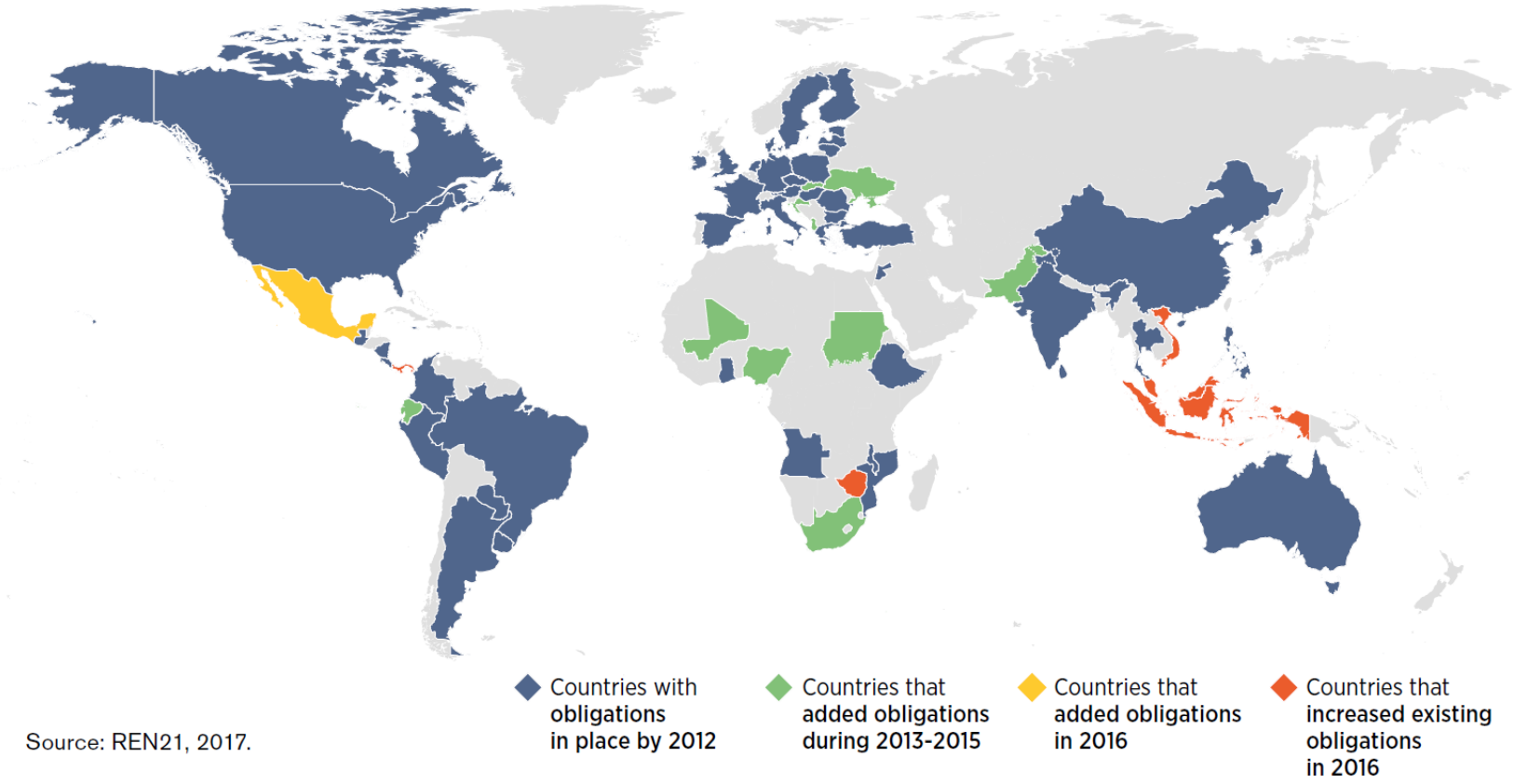




Data based on the Global Energy Transformation: A Roadmap to 2050 (IRENA 2019)

Growing demand in biofuel for transport sector

Countries with biofuel obligations in 2016

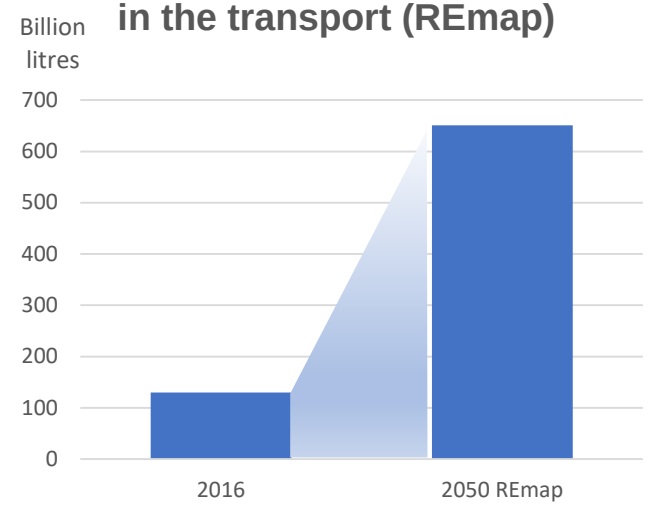


Source: REN21, 2017.

New policies since 2017

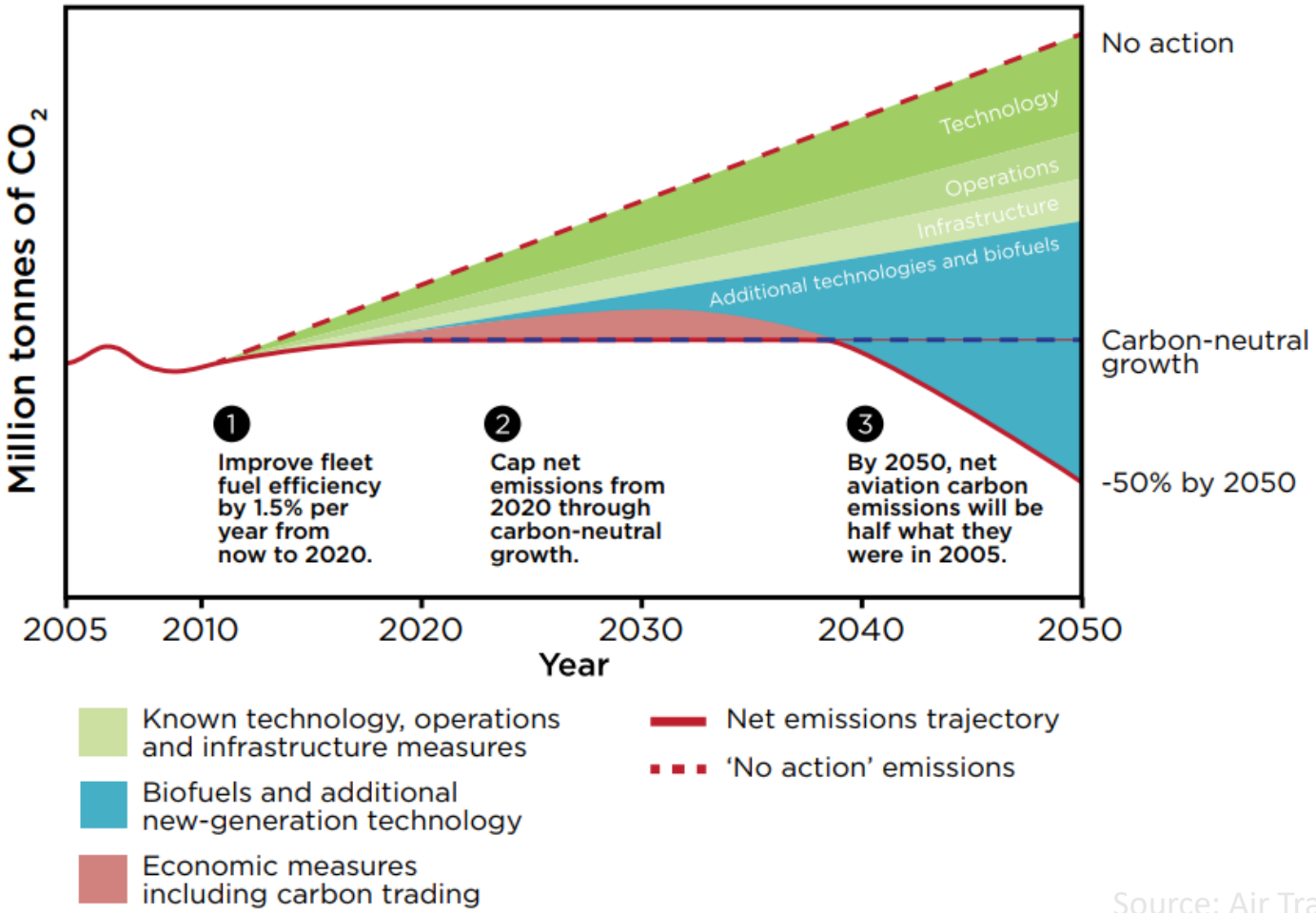
- Brazil – RenovaBio
- China – Nationwide E10 by 2020
- Canada – Federal Clean Fuel Standard; Some provinces boost blending
- India – National Biofuel Policy 2018
- Bolivia E25 by 2025

Demand for liquid biofuels in the transport (REmap)



International aviation climate target

- An average **improvement in fuel efficiency** of 2% per year from 2021 to 2050
- A cap on net aviation CO2 emissions from 2020 (**carbon-neutral growth**)
- A **reduction in net aviation CO2 emissions of 50%** by 2050, relative to 2005 levels



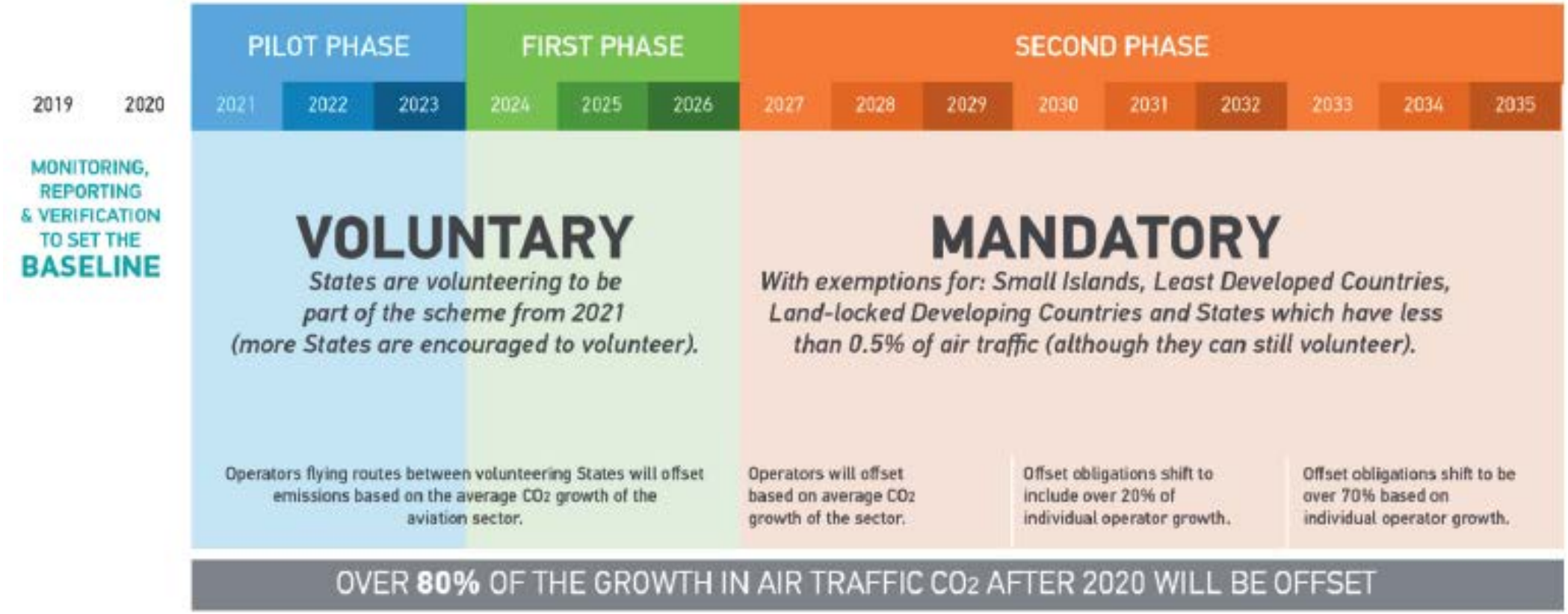
Biofuels are the best available alternative

- Oilseed crops on restored land (upgrade biodiesel)
  - Europe (rapeseed), China, Americas
  - FORBIO project – set aside land in EU
- Wood residues (thermochemical routes)
  - Uncollected logging residue in Scandinavia
  - Unrealised forestry potential in SE Europe
- Sugar/Energy cane (1G+2G ethanol plus conversion)
  - Brazil, Southern Africa, Caribbean
  - Economies from shared 1G/2G process steps
  - Future potential enhanced by high-yield energy cane

Source: Air Transport Action Group

Ways to decarbonise aviation sector

- Improved efficiency through better aircraft design and operation to reduce fuel per person-km or tonne-km
- Sustainable Aviation Fuel (SAF) to reduce carbon emissions from fuel still used in more efficient aviation
- CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation)

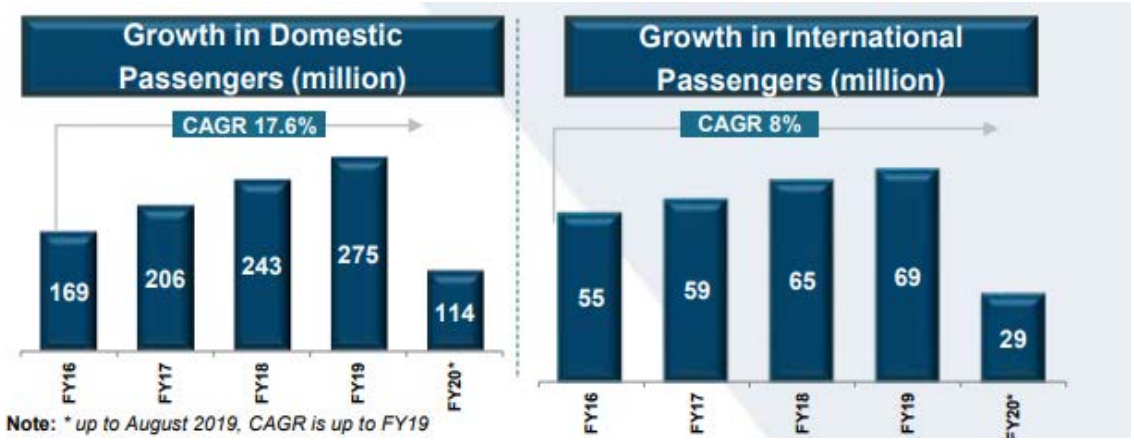


Source : IATA

India shows a steady growth in aviation sector

- India is expected to become third largest aviation market in terms of passengers by 2024 (IATA)
- Increasing number of airplanes (620 aircrafts in 2018 to 1,100 planes by 2027)

Key Trends



Source : IBEF

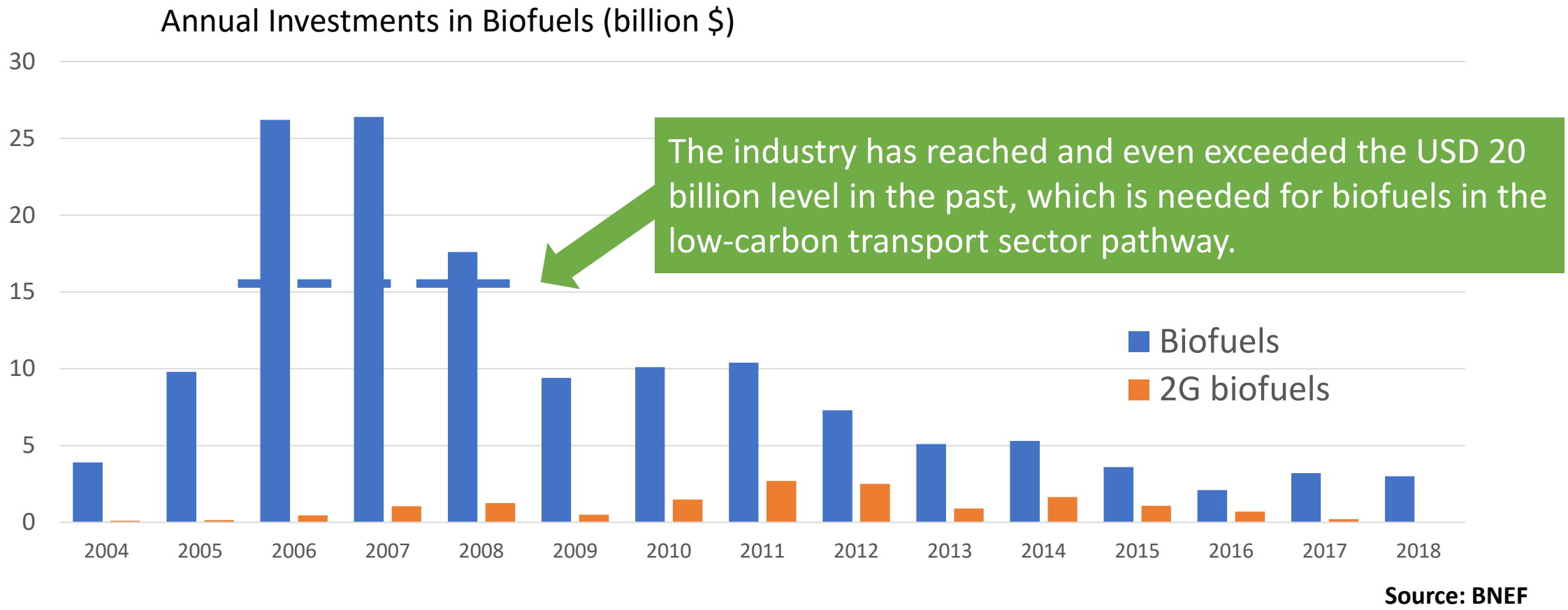
Rank	Departure country	Operations	CO_2 [MMT]	% of Total CO_2	RPKs (billions)	% of Total RPKs
1	United States[a]	Domestic	126	17	1,328	16
		International	56.1	7.4	650	7.6
		Total	**182**	**24**	**1,976**	**23**
2	China[b]	Domestic	65.9	8.8	781	9.2
		International	29.0	3.9	361	4.2
		Total	**94.9**	**13**	**1,142**	**13**
3	United Kingdom[c]	Domestic	1.51	0.2	12.0	0.2
		International	28.3	3.8	328	3.9
		Total	**29.8**	**4.0**	**350**	**4.1**
4	Japan	Domestic	9.41	1.2	95.5	1.1
		International	14.0	1.9	172	2.0
		Total	**23.4**	**3.1**	**267**	**3.1**
5	Germany	Domestic	1.53	0.2	12.4	0.1
		International	20.7	2.8	235	2.8
		Total	**22.2**	**3.0**	**247**	**2.9**
6	United Arab Emirates	Domestic	<0.01	<0.1	<0.01	<0.1
		International	21.1	2.8	233	2.7
		Total	**21.1**	**2.8**	**233**	**2.7**
7	India	Domestic	10.8	1.4	125	1.5
		International	8.60	1.2	109	1.3
		Total	**19.4**	**2.6**	**234**	**2.8**
8	France[d]	Domestic	4.53	0.6	48.9	0.6
		International	14.7	2.0	172	2.0
		Total	**19.2**	**2.6**	**221**	**2.6**
10	Australia[e]	Domestic	6.65	0.9	76.3	0.9
		International	12.3	1.7	144	1.7
		Total	**19.0**	**2.5**	**220**	**2.6**
10	Spain	Domestic	2.88	0.4	28.9	0.3
		International	15.6	2.1	203	2.4
		Total	**18.5**	**2.5**	**232**	**2.7**
Rest of the World			**298**	**40**	**3,381**	**40**
Total			**747**	**100**	**8,503**	**100**

Source : ICCT

Biofuels are taking off for India

- First flight using biofuel made from Jatropha (Dehradun and Delhi)
- Indian Airforce to expand use of blended biojet fuel (AN-32)

Global biofuel investments are on a declining trend



Source: BNEF

- To achieve the 5-fold increase goal, more than 100 refineries should be developed annually at an investment cost of USD 20+ billion.
- More than 10% of bioliquids should be allocated for aviation but the buildout of biojet refineries is slow.

Advanced Biofuels – what holds them back?

Scope of the study

✓ Clarify the factors explaining the stagnating investment activity in advanced biofuels

Method of analysis

✓ A review of past literature + survey with companies that have invested in 2G biofuel productions (14 respondents)

✓ Statements evaluated under the five following groups

- feedstock (8 statements)
- technology and financing (7 statements)
- markets through mandates and targets (16 statements)
- trends in consumer demand (12 statements)
- environmental and social concerns (11 statements)

✓ A ranking question about the level of various possible barriers

Released November 18, 2019

Barriers to investment in advanced biofuels - feedstock, technology and financing -

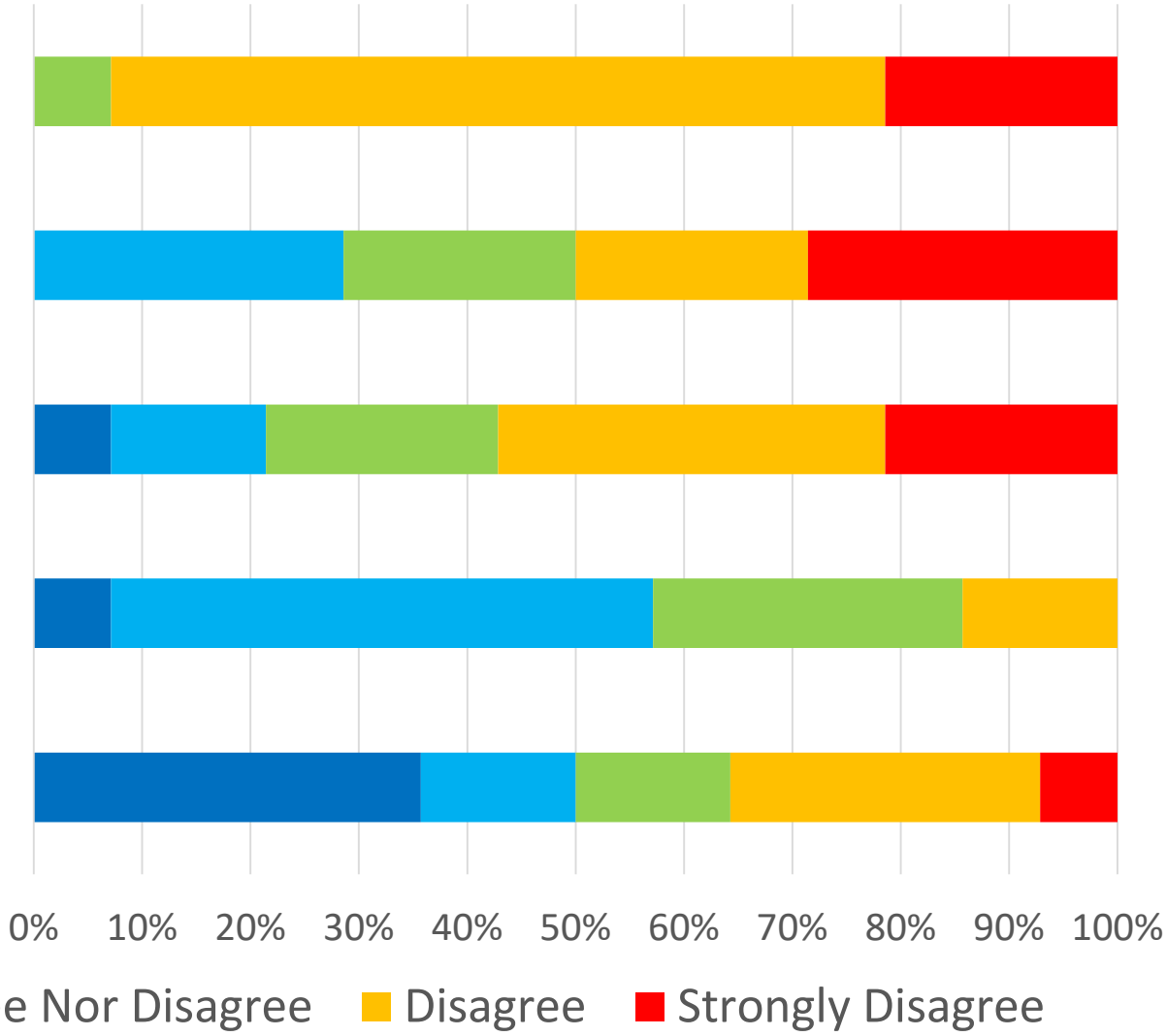
There is not enough feedstock for advanced biofuels business expansion.

Competing uses for biomass feedstock (e.g. heat, power and bioproducts) pose a major risk for our biofuel business.

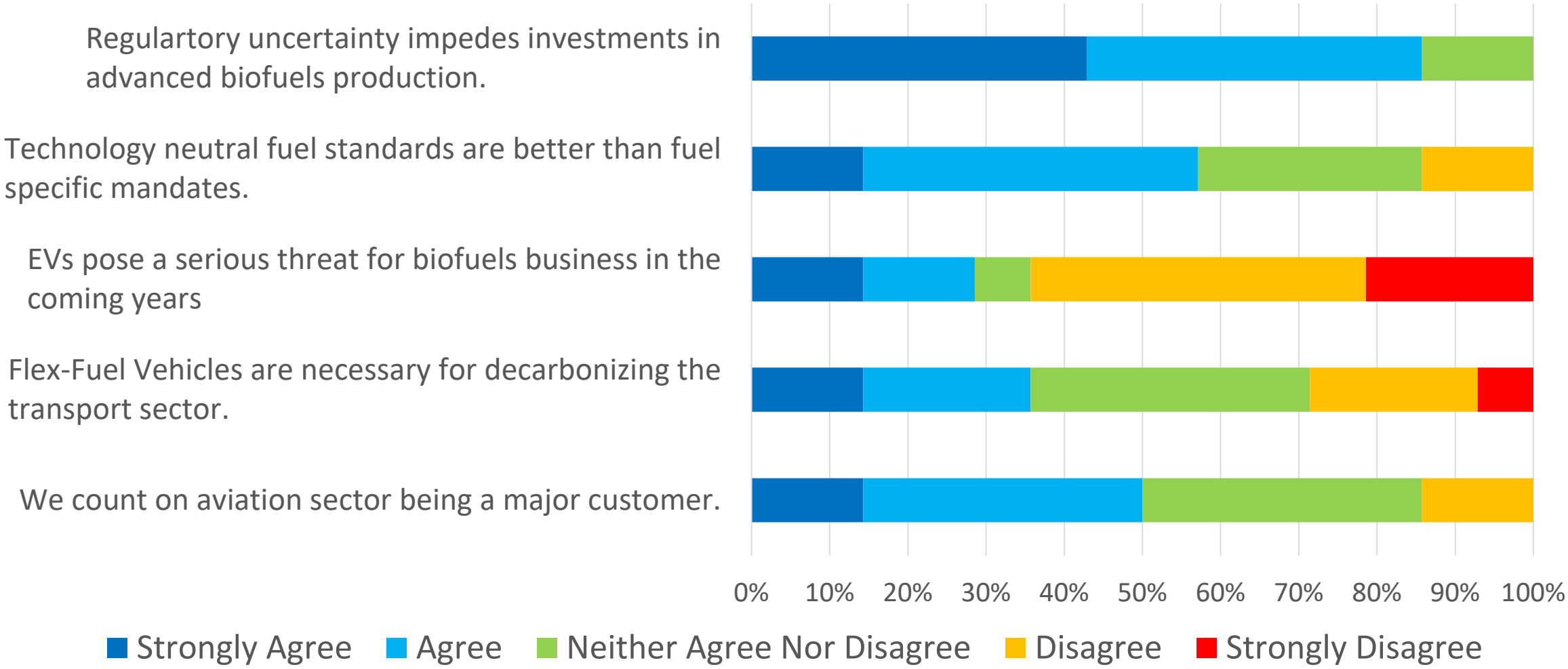
Technology is not ready for large scale advanced biofuels deployment.

Lignocellulosic biofuels will reach significant volume by 2030

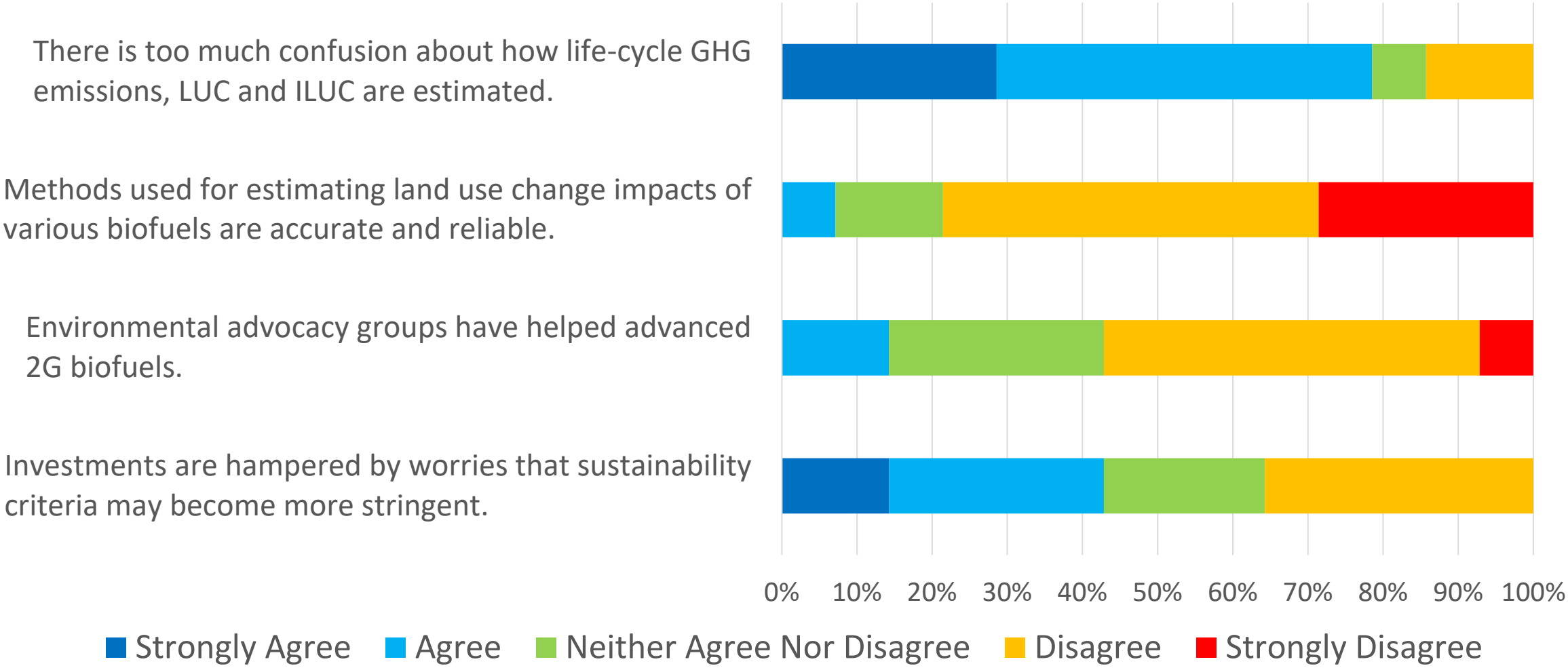
Availability and cost of financing is a major barrier to investment in advanced biofuels.



Barriers to investment in advanced biofuels - mandates, targets and demand -



Barriers to investment in advanced biofuels - environmental and social concerns -



What really matters? - *Ranking the barriers*

- The most important group of barriers relates to lack of stable regulation, including mandates and subsidies.
- It is followed by the difficulty of financing (availability and cost) and cost competitiveness of advanced biofuels production, including conversion efficiency & CAPEX.

Some concluding thoughts

- Transport sector decarbonisation calls for accepting several fuel alternatives simultaneously rather than resorting to a single, all-encompassing solution
  - Advanced biofuels constitute a complementary/competing option
- Advanced biofuel conversion technologies are needed to diversify the range of feedstocks to include farm and forest residues and wood crops; competition for biomass feedstock may raise prices
- Advanced biofuels should become cost competitive given expected oil prices and carbon values, if investment is made to get to “nth” plants and efficient logistic chains are identified to utilise abundant feedstocks
- Advanced biofuel, especially Biojet, needs to be scaled up at global-scale

Some concluding thoughts – cont.

- Policy uncertainty is found to be the most significant barrier to investment in biofuels, making it important to have close dialogues between policy makers and business sector
- Both technology push and market pull policies are key to bring more offtakers
- Low subsidy levels, high financing costs and limited availability of finance are seen by many executives as barriers in the current market
- Industry executives question the accuracy and reliability of common methods for estimating GHG emissions, land-use change and indirect land-use change
- As the adoption of clean technologies grows across sectors, technology improves, renewable fuel costs fall and regulation becomes more favourable, carbon-neutral options are expected to become more competitive in the medium to long-term

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