



IEA Bioenergy

Technology Collaboration Programme

Task 39
IEA Bioenergy



Implementation Agendas Report: 2020-2021 Update (compare-and-contrast biofuels policies)

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Technology Collaboration Programme

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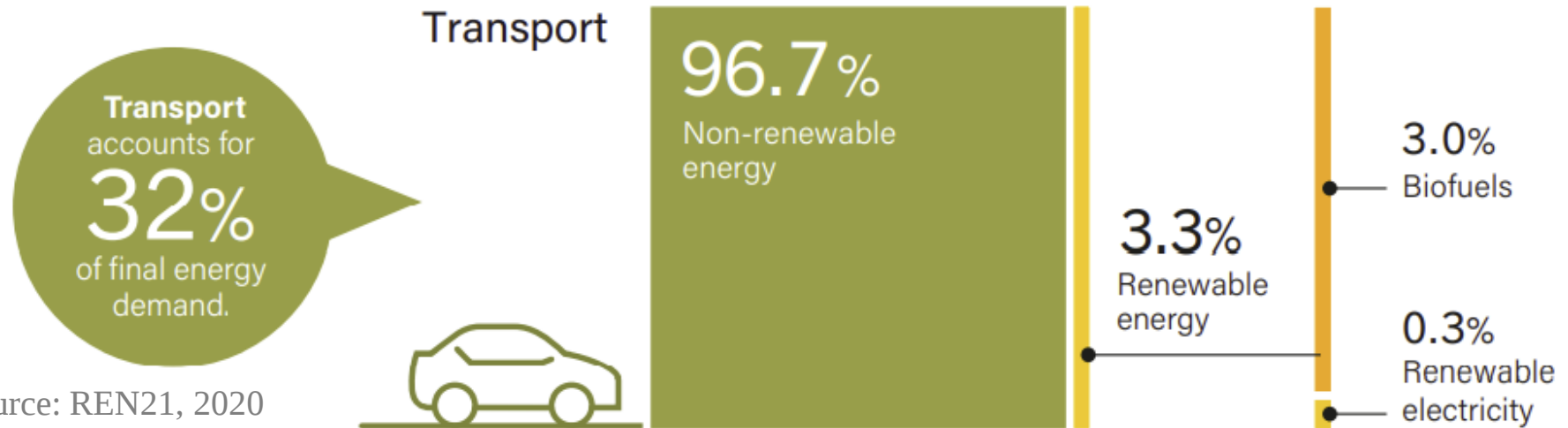
Implementation Agendas Report

- Since 2007, IEA Bioenergy Task 39 has been assessing the measures taken by its member countries to develop or stimulate their respective biofuels sectors, with the particular focus on biofuel policies
- The overall goal of such assessment is to determine the extent to which these policies have been effective in encouraging the production and use of transport biofuels
- Task 39's member countries represent a diverse sample of regions and biofuels producers and consumers and include some of the key producing countries and regions worldwide (e.g., the US, Brazil, and the European Union (EU))
- Five updates of the report have been published by Task 39 in the past including 2007, 2009, 2014, 2017 and 2019 updates

New additions to the 2020-2021 update Draft

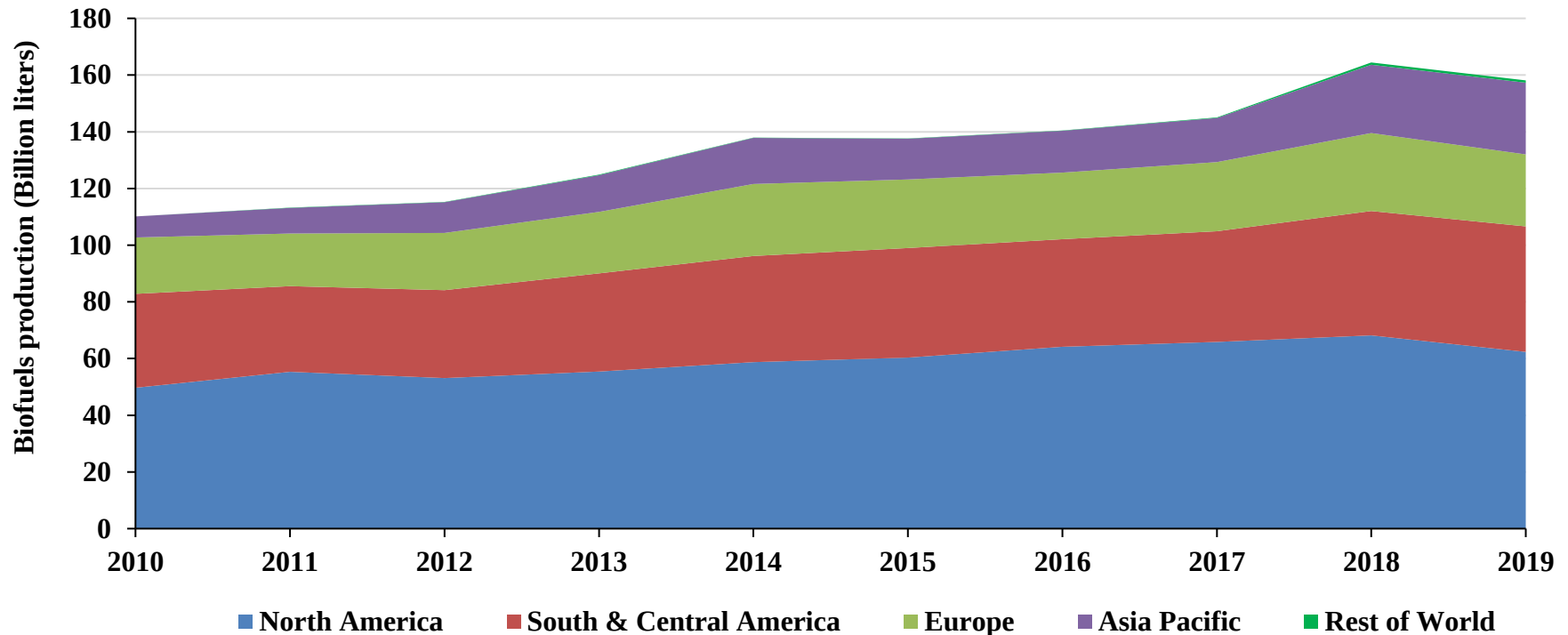
- Two new country chapters: **Norway and Ireland**
- **Historical GHG emissions inventory data** and the contribution of transport sector to the national GHG emission inventory
- Historical development of biofuels and GHG emissions policies
- **Existing and emerging sustainability certification schemes** for transport biofuels and feedstocks
- **Compliance cost** of biofuel policies (e.g. \$/tCO₂, \$/GJ).
- Historical biofuels and feedstocks imports and exports
- **Co-processing** trials/demonstrations at oil refineries

Biofuels continue to be a central component of the decarbonization of the transport sector



- Despite a trend towards greater electrification of road transport, **biofuels (mainly ethanol and biodiesel) account for more than 90% of renewable energy in the transport sector** and remain central to many national and sub-national renewable transport policy frameworks.
- Biofuels have been primarily used in the road transportation which accounts for about 77% of the energy use in the transport sector

Globally, biofuels production has continued to increase over the last decade, but has slowed down in recent years



- Globally, biofuels production has continued to increase from about 64 million tonnes oil equivalent (Mtoe) produced in 2010 (~110 billion liters) to about 92 Mtoe in 2019 (~158 billion liters).
- Task 39's member countries including the US, Brazil, Germany, the Netherlands and Canada are among the top ten biofuels producing countries globally, altogether, contributed to about two-thirds of the world's biofuels production in 2019.

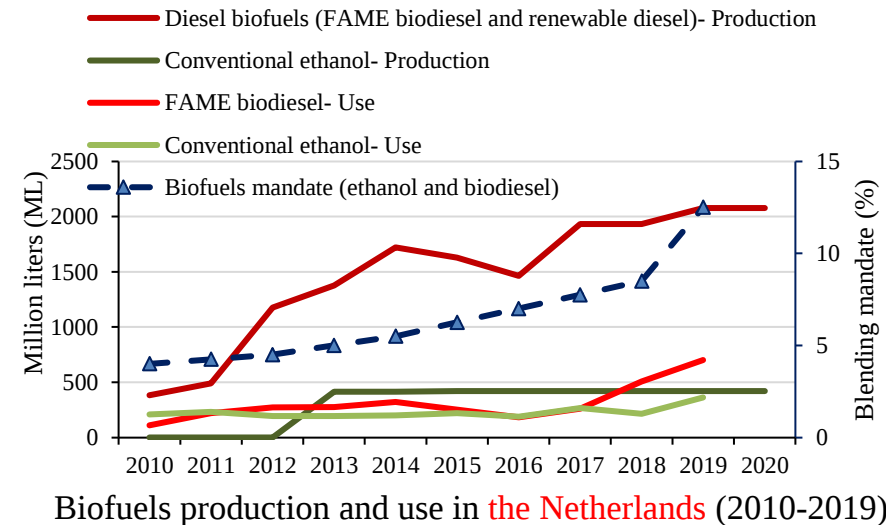
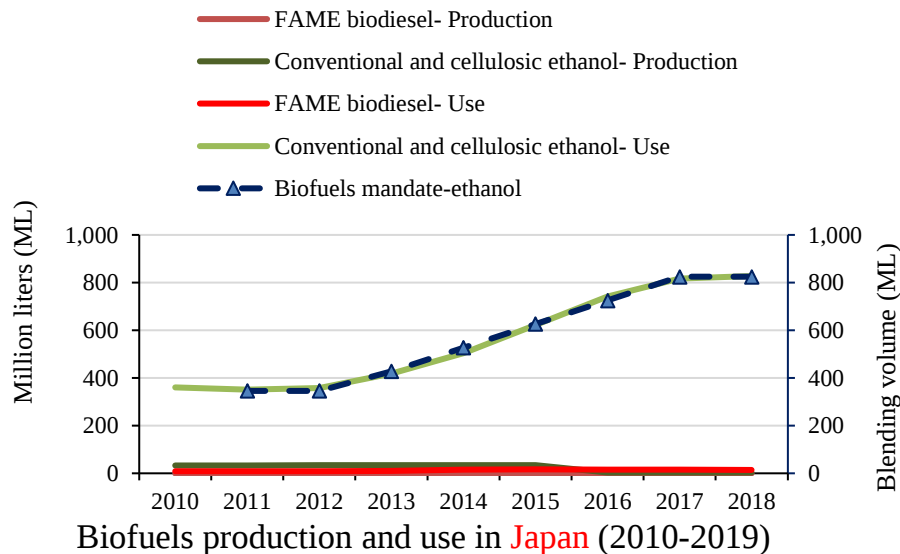
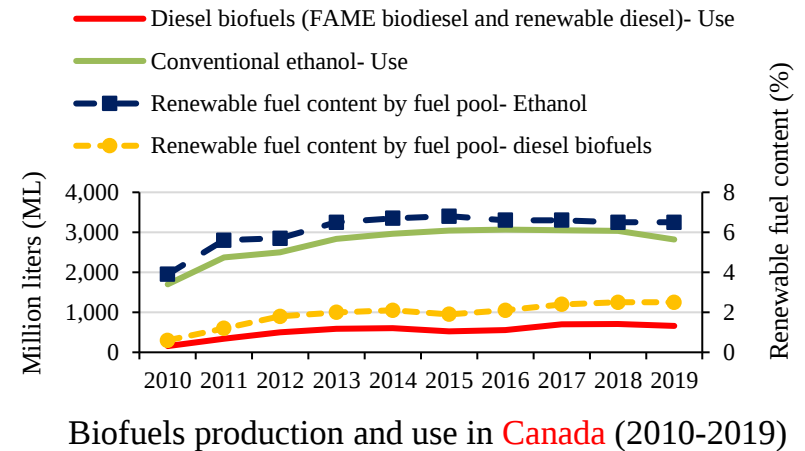
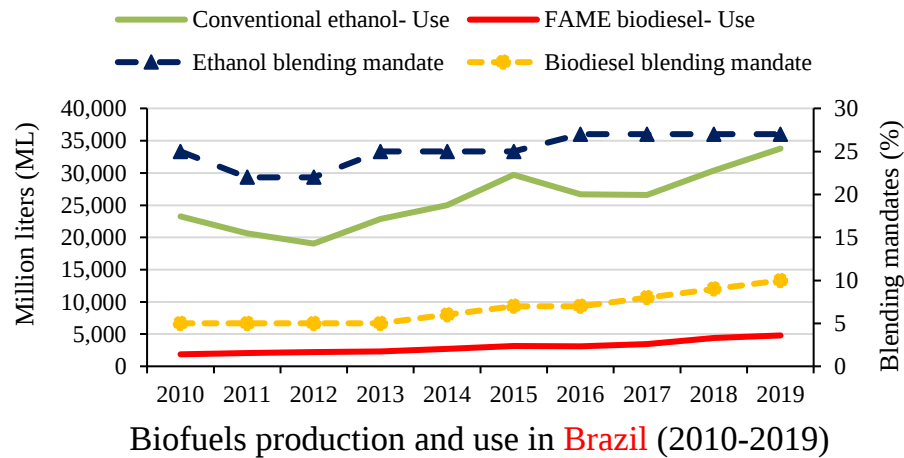
Biofuel policies in Task 39's member countries

- Task 39's member countries have developed and implemented **many forms of biofuel policies** to encourage the production and use of biofuels to decarbonise the transport sector, in particular road transportation
- Most of member countries have used **a combination of market-pull and technology-push policies** to propel the production and use of biofuels at different stages of technology and market development.
- **Biofuel blending mandates remain one of the most widely adopted mechanisms** for increasing biofuels use in the transport sector. Overall, 65 countries had blending mandates as of the end of 2020.
- However, **the number of Low Carbon Fuel Standard (LCFS) policies are growing** at sub-national and national levels.
- Some of the LCFS-type policies have been built on the existing Renewable Fuel Standards (RFS), which are called **Modern RFS (e.g., Provinces of Ontario and Quebec in Canada)**. **Germany and Sweden** have also shifted from energetic related quota to a GHG related quota.

Main drivers for biofuels policy development in Task 39 member countries

- The issues of **energy security, rural development and job creation** were identified as the main drivers behind the **initial development of biofuels policies** in the member countries.
- **Energy security and rural development** have been the primary drivers for developing policies in countries **such as the US, Brazil, and India** where substantial commercial production of feedstocks such as corn, oilseeds and sugarcane are produced annually
- More recently, policies that try to **foster mitigation of climate change, such as reducing the carbon intensity of the transport fuels**, have become an increasing focus in biofuels-related policy development (e.g., **EU member states and Canada**)
- **In Japan**, where there is little availability of affordable feedstocks for biofuel production as well as large **concerns about security of food supply, GHG emission reduction** has been the main driver for using biofuels.
- **In South Korea**, becoming a leader in the development and deployment of **clean energy technologies**, and making this a new growth engine to improve the quality of life, has influenced the development of biofuels policies.

Blending mandates have fostered the growth of biofuels markets in many member countries



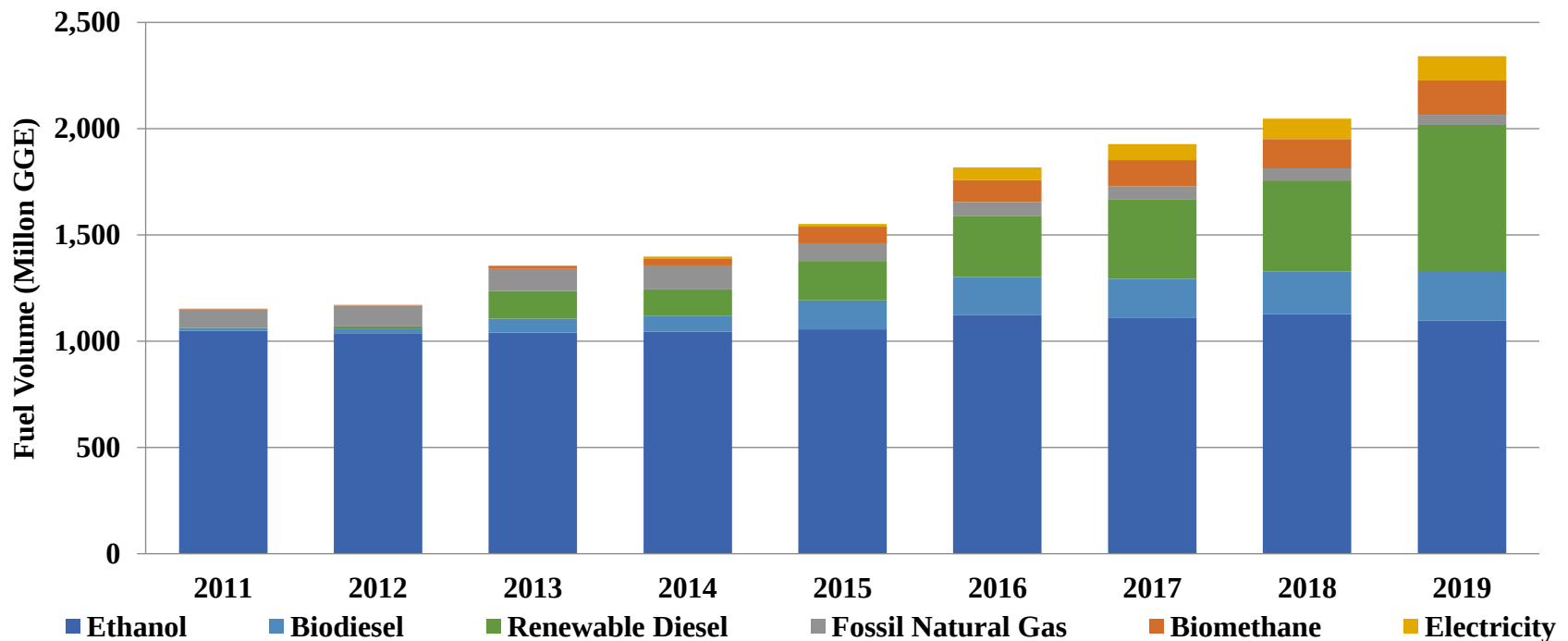
But the blending mandates have not resulted in the growth of biofuels markets in all member countries

- The reasons why mandates have not worked well in some jurisdictions are varied and include a **lack of feedstock (e.g., South Korea), high feedstock costs due to competing uses (e.g., Australia), shortage of infrastructure and food security and sustainability concerns such as indirect land use changes (ILUC) (e.g., Japan).**
- While biofuel mandates have been shown to reduce transport sector GHG emissions, **mandated biofuel obligations are typically based on a biofuel's volume or energy content rather than its decarbonisation potential**
- **“Modern blending mandates”** have been recently developed (e.g., Sweden, Germany, two Canadian provinces of Ontario and Quebec) that has resulted in the flow of low-carbon biofuels to these jurisdictions.

Growing interest toward LCFS policies

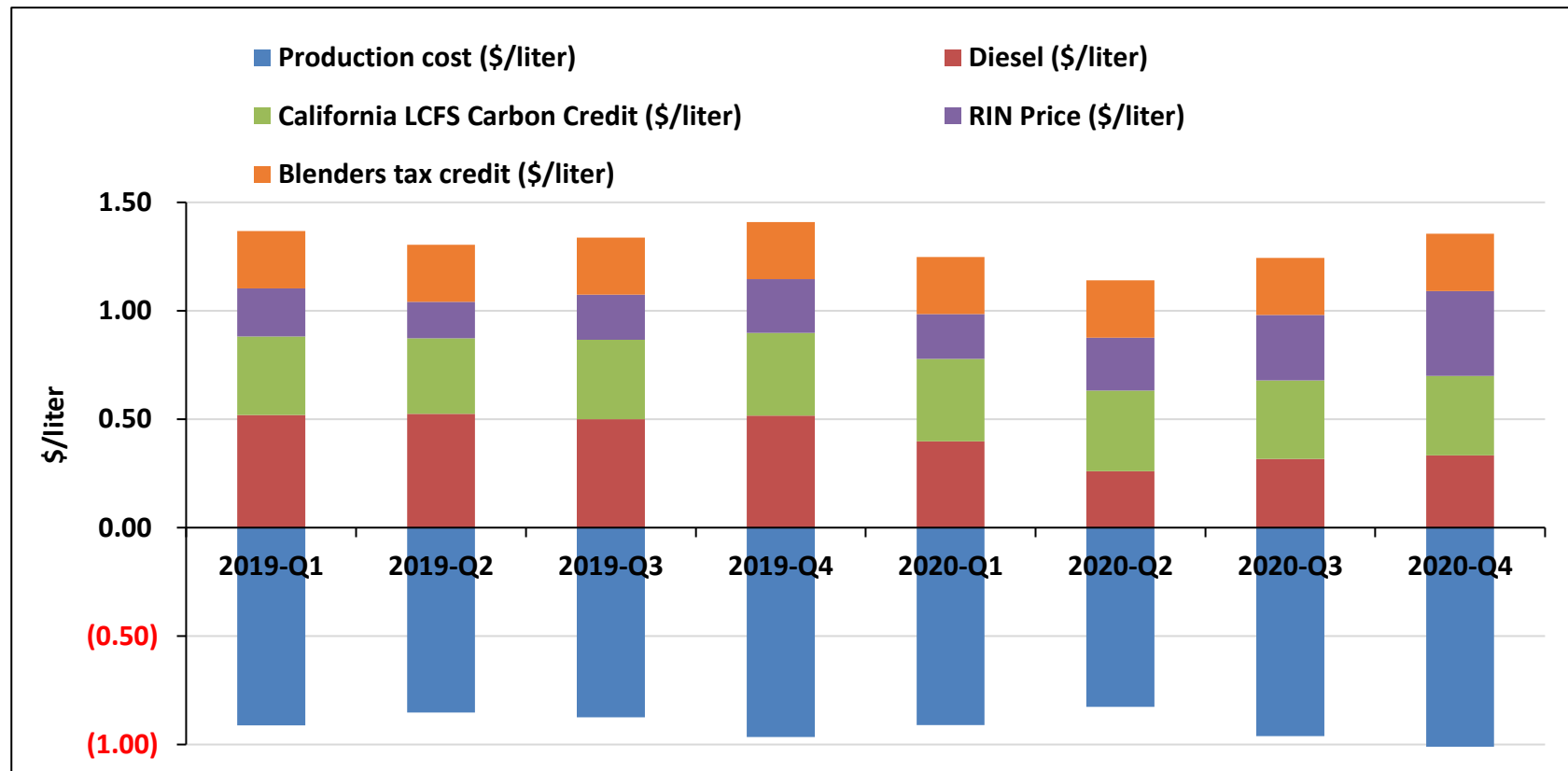
- In contrast to biofuels blending mandates, LCFS policies **do not have blending limits and minimum GHG emission reduction requirements** for specific fuel categories
- **California and British Columbia** are at the forefront of these **policies**, followed by Oregon and Washington States.
- In recent years, **Canada and Brazil** have been developing national LCFS-type policies to encourage the production and use of low carbon fuels.
- **Several states in the US including Washington, New York, New Mexico, Colorado Minnesota, and MidWest States** are contemplating adopting LCFS programs.

California LCFS has been driving the growth of drop-in/advanced biofuels



- **The volume of low carbon fuels** consumed in California increased from 1,152 million gasoline gallon equivalent (GGE) in 2011 to 2,314 GGE in 2019, (**more than double increase**) over the period of 2011-2019.
- **Renewable Diesel has experienced the fastest growth among other alternative fuels** in California, increasing from 2 million gasoline gallon equivalent (GGE) in 2011 to 692 million GGE in 2019.

Bridging the price gap for drop-in/advanced biofuels by a mixture of biofuels policies- The US and California Case



Renewable diesel retail price in California, 2019-2020

Co-processing in member countries

Low carbon intensive fuels via co-processing has been produced in **Sweden, Brazil, the US, Canada, Austria and Norway.**

Sweden

- Preem has been marketing “**Preem Evolution Diesel**” since 2011 with this drop-in fuel having a **20% renewable content**, primarily based on **Tall Oil feedstocks and recently used cooking oil and animal fats**
- Preem currently operates at a **30% co-processing blend**
- Preem (oil refinery), BTG (the producer of bio-crude from woody biomass) and other partners plan to commercialize FCC fast pyrolysis co-processing in Sweden.

• The US

- **Chevron, BP and Phillips66 oil refineries in the US** have conducted several trials regarding co-processing of lipid feedstocks (up to 5%).
- **Two refiners have California LCFS approved pathways.** Co-processing pathway has also **being approved by the US EPA to generate RINs under RFS program as an advanced biofuels**

• Canada

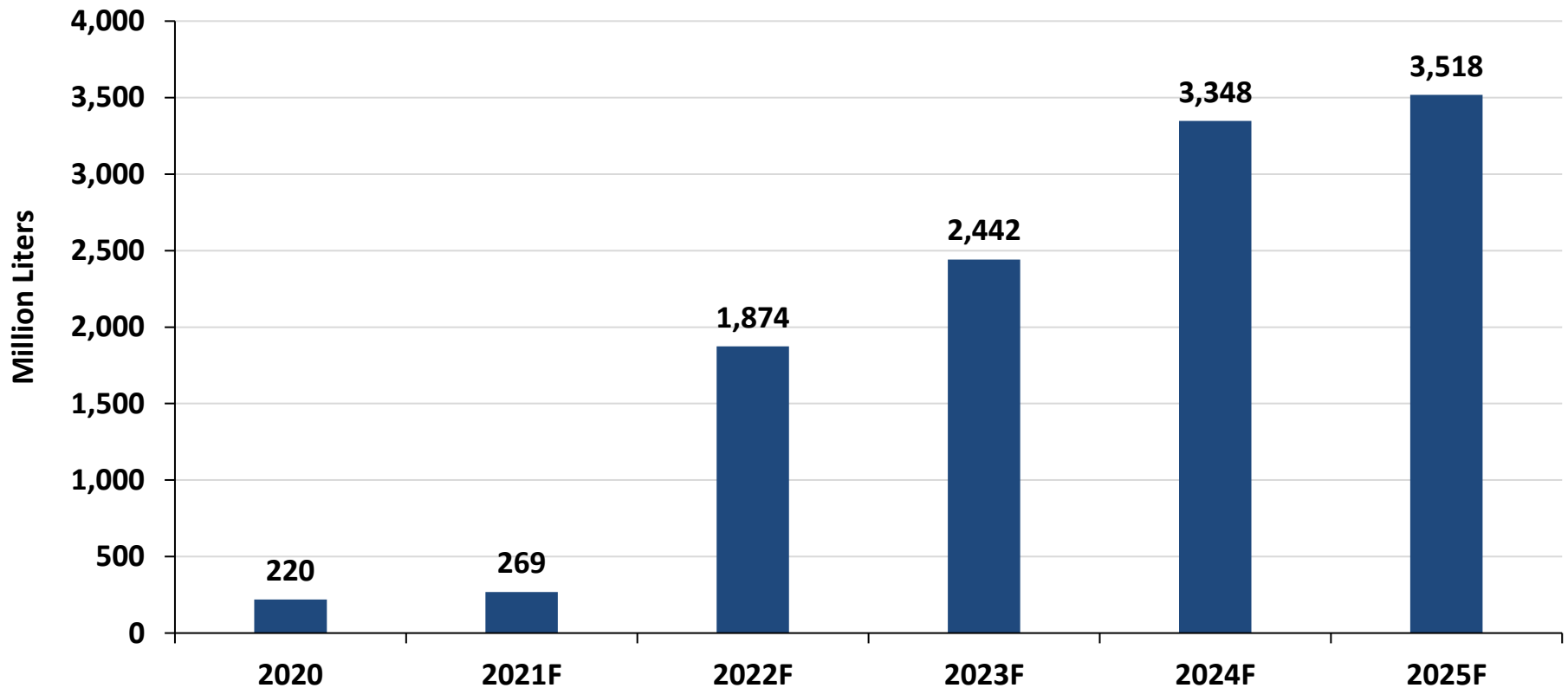
- **British Columbia’s Part 3 agreement** has encouraged both oil refineries in BC to consider co-processing as an economically attractive compliance pathway.
- The Parkland refinery has been co-processing “**waste oils**” (e.g. **animal fats**) and **canola oil**.
- Assuming **5% co-processing rate**, Parkland can potentially produce **80 million liters/year** of low carbon intensive fuels.

Aviation and Marine sectors are still lacking behind the road transportation in terms of policy supports

- Most of the policies that have been used to promote renewable energy for transport **have primarily focussed on road transport at a national level.**
- Other important transport sectors such as aviation and shipping have received **considerably less policy attention** despite being significant energy consumers and carbon emitters.
- However, regulators at the regional, national, and local level are starting to develop policies **to support the penetration of biojet/SAF**
 - 2020 – Norway mandate of 0.5% SAF
 - 2030 – Norway mandate increases to 30%
 - 2021 – Sweden proposal for 0.8% emissions reduction obligation for domestic jet fuel
 - 2030 – Sweden mandate for 27% reduction in emissions
 - 2035 – Finland targets 30% SAF in aviation
 - SAF blender's tax credit in the US
 - Aviation is included in the EU's Emission Trading Scheme (ETS).
 - In the US, SAF can be used to meet the advanced biofuel targets under the Renewable Fuel Standard (RFS), a federal mandate for the road transport sector.
 - In California, the Air Resources Board (CARB) has approved a pathway that allows the voluntary use of hydroprocessed esters and fatty acids (HEFA) under its Low Carbon Fuel Standard (LCFS).

Biojet/SAF production capacity growth (2020-2025)

Biojet/SAF Production Capacity Growth: 2020-2025



- With the announced biojet/SAF production projects in the US, Europe and Singapore, the production capacity is expected to grow from **220 million liters in 2020 to over 3,500 million liters in 2025**



Sustainability requirements are increasingly being incorporated into biofuels policies

- **Life Cycle Assessment (LCA) of GHG emissions** is currently the predominant method used to assess the sustainability of many renewable fuel pathways, including biofuel blending mandates.
- Member countries such as **Austria, Denmark, the Netherlands and the US** have addressed sustainability concerns by introducing **specific mandates for more sustainable advanced biofuels** as well as providing direct financial incentives.
- **The US, through its federal level RFS2, and California, through its state level LCFS,** support the development of advanced biofuels by valuing them higher than conventional biofuels in trading mechanisms.
- Countries such as **Australia support the development of advanced biofuels** through research and development grants.
- The under-developed federal Clean Fuel Standard (CFS) regulations in Canada (coming into force in December 2022) will **require the consideration of additional sustainability criteria beyond LCA** such as land use change and biodiversity, the riparian and protected zones for the use of agricultural and forest biomass in the production of advanced biofuels.

Conclusions

- Biofuels production and consumption data for the 11-year period of 2010-2020 showed that in most of the member countries, **biofuels policies played an important role in developing and growing regional and national biofuels markets.**
- Based on information collected from member countries, existing biofuels policies have a range of strengths and limitations. Thus, **a mixture of market-pull and technology-push policy instruments is typically used to try to establish or grow current biofuels markets.**
- **Biofuel blending mandates or obligations remain the primary biofuels policy tool** that has been used by most of member countries and they have been used successfully to establish and grow biofuels markets.
- More recent policies, such as **LCFS**, are spurring development and production of lower carbon intensity fuels, **including drop-in and advanced biofuels.**
- It is expected that the number of **policies related to long-distance transport** such as aviation and marine will increase, in particular the aviation sector where alternatives to using biofuels to achieve decarbonization targets remain elusive.
- **Sustainability requirements are increasingly being incorporated into biofuels policies**, mainly with LCFS-type policies that incentivize reductions in carbon intensity and assure sustainability increasingly being used.