

Implementation Agendas Report: **(compare-and-contrast policies used to develop biofuels)**

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**IEA Bioenergy Task 39, Business Meeting, San Francisco,
November 5th , 2018**

About Myself

- **Education:** B.Sc. And M.Sc. in Industrial Engineering and Ph.D. in Forestry
- **Area of expertise:** Supply Chain Management and Lean Manufacturing
- **Main project:** Development of the simulation platform, Integrated Biomass Supply Analysis and Logistics (IBSAL)
 - Wood pellet and forest residues
 - Agricultural residues (e.g. corn stover and wheat straw)
 - Dedicated biomass crops including Miscanthus, Willow, Hybrid Poplar and Switchgrass
 - Municipal solid waste

Implementation Agendas Report

- **Compares and contrasts developments in liquid biofuels production and use in member countries**
- **Focus on biofuel policies and the extent to which these biofuels policies have been effective**
- **Assesses the measures taken by member countries to develop or stimulate their respective biofuels sectors, including incentives and investment in research, development and commercialization**
- **Provide an update on the current status of biofuel sustainability assessments and related discussions that factor into policy development**

Methodology

1. Developed a new questionnaire
2. Sent out the questionnaire to member countries
3. Collected the completed questionnaires from country representatives, compiled the information and reviewed/ incorporated recent related publications
4. “Polished” each country’s contribution to try to make them more comparable
5. Shared the draft country sections with each country representatives for their review/feedback
6. Prepared a draft implementation agendas report

Implementation agenda report

- **Main drivers for biofuels policy**
- **Biofuels policy**
 - **Biofuels obligations**
 - **Excise duty reductions**
 - **Fiscal incentives**
 - **Investment subsidies**
 - **Other measures stimulating the implementation of biofuels**
- **Promotion of advanced biofuels**
- **Market development and policy effectiveness**

Existing Policies for biofuel production and use

- **Biofuel blending mandates (still the primary policy tool)**
 - Appears to be the most effective in establishing biofuels markets and in shielding biofuels from low oil prices, but not necessarily so useful in expanding/maintaining markets
 - Not necessarily the best way to meet GHG reduction targets
 - With the exceptions of New Zealand and South Africa, other member countries have biofuel blending mandates in place
 - In addition to blending mandates for conventional biofuels, the US and some EU member states, including Austria, Denmark and Netherlands, have developed/are developing blending mandates for advanced biofuels

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Biofuel blending mandates

Country	Biofuels blending mandate
Australia	No national renewable fuels target New South Wales (NSW): 5% biodiesel and 6% ethanol Queensland: 0.5% biodiesel and 4% ethanol
Austria	6.3% biodiesel, 3.4% ethanol and 5.75% biofuels in energy content 0.2% advanced biofuels target by 2022
Brazil	27% ethanol, 10% biodiesel
Canada	Federal use mandates: 5% ethanol and 2% biodiesel Five provinces of British Columbia, Alberta, Saskatchewan, Manitoba and Ontario established a blending requirement of 5% to 8.5% for ethanol in gasoline and 2% to 4% for renewable content in diesel
Denmark	5.75% biofuels (both ethanol and biodiesel) in energy content 0.9% for advanced biofuels by 2020
Germany	GHG reduction of 3.5%/4%/6% in the fuel mix for the entire fuel sector from 2015/2017/2020 onwards. Target continues after 2020 at the level of 6%.
Japan	500 million liter ethanol mandate Introducing 10 million liters (crude oil equivalent) of second generation biofuels
Netherlands	6.25% biofuels (both ethanol and biodiesel) in energy content 0.5% for advanced biofuels in 2020
New Zealand	No mandate on biofuel use or any biofuel volume obligations
South Africa	No mandate on biofuel use or any biofuel volume obligations
South Korea	2.5% mandate for biodiesel (volume basis)
Sweden	5% mandate for both ethanol and biodiesel GHG emissions reduction of 2.6% for gasoline and 19.3% for diesel
USA	Volume targets of biofuels including conventional corn-based ethanol and advanced, cellulosic and biodiesel biofuels

Existing Policies for biofuel production and use

- **Fuel/CO₂ excise reduction/exemption and tariff**
 - Currently used by 10 member countries
 - Mainly used to make the production of biofuels economically competitive with fossil fuels in the short and mid-terms
 - Without supplementary policies such as biofuel mandates, this policy is not a strong driver to establish biofuels markets
 - As biofuels production becomes more cost efficient and the price of oil gradually increases, the fuel excise reduction/exemption incentive has been either modified or lifted.

Fuel excise reduction/exemption and tariff

Country	Fuel excise reduction/exemption
Australia	Producer Grant Scheme (fuel excise reduction)
Austria	Tax concessions for fuels with a biofuel share of at least 4.4% Pure biofuels exempted from mineral oil tax
Brazil	Tax incentive for ethanol use and ethanol and biodiesel import tariff
Canada	-
Denmark	CO ₂ excise exemptions for biofuels
Germany	Fuel excise reduction for biofuels
Japan	No diesel oil delivery tax for B100 A special tax incentive for the consumption of bioethanol Imports of bio-ETBE is encouraged through a zero tariff
Netherlands	-
New Zealand	Fuel excise exemption for ethanol (including imported ethanol) No excise exemption for biodiesel
South Africa	Fuel excise exemption for ethanol Biodiesel manufacturers receive a rebate of 50% on the general fuel levy.
South Korea	-
Sweden	Full tax exemption for biofuels. The tax is divided into energy and CO ₂
USA	tariffs and restrictions on imports of biodiesel (until 2017) and ethanol (continuing)

Existing Policies for biofuel production and use

Country	Other policy mechanisms
Australia	-
Austria	-
Canada	British Columbia's Carbon Tax and Low Carbon Fuel Standard Ontario's auction for carbon allowances Alberta's carbon levy
Denmark	
Germany	Carbon tax are indirectly applied via CO ₂ tax for passenger cars
Japan	-
Netherlands	-
New Zealand	Emissions trading scheme
South Africa	
South Korea	
Sweden	Rebate to car buyers for certain vehicles
USA	California's Low-Carbon Fuel Standard

Existing Policies for biofuel production and use

- **Low Carbon Fuel Standard (LCFS)**
 - Proven to be a successful tool to decarbonize the transportation sector by encouraging the reduction of carbon intensity of renewable fuels including biofuels
 - California and British Columbia are at the forefront of the implementation of this policy
 - Although most of the member countries have requirements for the specific GHG reduction of biofuels compared to the fossil fuels as part of their sustainability criteria, only Germany and Sweden have implemented GHG reduction quota obligation for biofuel use in their transportation sectors

Existing Policies for biofuel production and use

- **Low Carbon Fuel Standard (LCFS)**
 - LCFS has spur innovations in the conventional biofuels market to reduce their carbon intensity such as the development of bolt-on and integrated conversion technologies to convert corn kernel fibre into cellulosic ethanol and/or reusing and selling the carbon dioxide (CO₂) produced by ethanol plants as a byproduct (instead of going to waste)
 - In addition to conventional biofuels, it has spurred production and use of low-carbon advanced biofuels and HVO/HEFA biofuels.

Financial schemes, investment subsidies and incentives

Member countries have various funding programs to further encourage production and use of biofuels, especially advanced biofuels.

- Grants for the development of conversion technologies at different readiness levels
- Loan guarantee programs
- Corporate tax breaks
- Guaranteed return on renewable energy assets
- Compensating the depreciation or the acquisition of renewable energy assets
- For biofuel users: rebate or bonus to car buyers purchasing certain vehicles such as flex-fuel vehicles. Other rebates such as reduced license fees and tax credit
- Funding municipalities or companies when buying alternative fuel vehicles

Production and use of biofuels

Country	Ethanol	Biodiesel	Drop-in/Advanced biofuels
Australia	Production capacity of 440 million liters	No production	No production
Austria	Production capacity of 228 million liters	Production capacity of 345 million liters	Two operational and planned pilot/demo scale plants
Brazil	Production capacity of 30,800 million liters	Production capacity of 4,300 million liters	Total cellulosic ethanol production of 25 million liters
Canada	Production capacity of 1,700 million liters	Production capacity of 591 million liters	Two commercial plants producing cellulosic ethanol and bio-crude oil
Denmark	No production	Production capacity of 387 million liters	A demo plant producing ethanol from wheat straw. The plant is not currently operational
Germany	Production capacity of 2,994 million liters	Production capacity of 3,500 million liters	There are many ongoing RD&D at pilot and demo levels.
Japan	Production capacity of 2 million liters	Small production capacity mainly for meeting the demand of municipalities	There is a demo plant with the production capacity of 1.6 million liters of cellulosic ethanol
Netherlands	Production capacity of 420 million liters	Production capacity of 400 million liters	There is a renewable diesel plant (HVO) with a capacity around 1,230 million liters
New Zealand	Production capacity of 4.84 million liters of ethanol	Production capacity of 0.47 million liters of biodiesel	No production
South Africa	No production	No production	No production
South Korea	No production	Production capacity of 1,162 million liters of biodiesel	
Sweden	Production capacity of 23 million liters	Production capacity of 20 million liters	There is a renewable diesel plant (HVO) with a capacity around 20 million liters and a cellulosic ethanol plant with 2 million liters capacity
USA	Production capacity of 60,000 million liters	Production capacity of 6,000 million liters	In 2017, total production of renewable diesel, cellulosic biofuels, and biojet was 453, 10, and 1.7 million gallons, respectively

Challenges to further production and use of biofuels

- Petroleum prices remain modest and future policies for renewable fuels remain highly uncertain.
- Inconsistency in the implementation of biofuels policies such as granting liable parties exemptions and waivers in US and Australia
- Slower-than-anticipated progress in scale up and deployment of commercial production of cellulosic ethanol and other advanced biofuels
- Lack of secure supply of commercial quantities of low-cost feedstocks
- Lack of fuel distribution infrastructure, and conflict with the business models of existing oil companies
- Low levels of consumer/investor knowledge and acceptance
- Fragmented biofuels supply chain

Changes in the biofuels policy landscape

- The ambitious GHG reduction goal in the Paris Agreement has made the signed countries to create/revisit policies to propel the production and use of biofuels as one of near-term and mid-term solutions to decarbonize the transportation sector.
- Development of blending mandates/GHG reduction quota obligation to decarbonize long-distance transport sectors such as aviation and marine industry
- Policy interest in advanced biofuels remains strong. The Biofuture Platform, a 20 member country collaboration initiated by Brazil, has advocated an increase in low-carbon advanced biofuel consumption. India, China intends to “vigorously develop” cellulosic ethanol.

Changes in the biofuels policy landscape

- EU policy support for advanced biofuels after 2020 is also expected to strengthen, building on an increasing number of quota policies.
- Shift toward GHG reduction quota obligation and carbon intensity rather than volume mandates to meet GHG reduction goals.
- Recognition of co-processing at refineries as a way to award compliance credit for activities that have a reasonable chance of increasing the supply of low carbon fuels
- Change in sustainability criteria, limiting the use of food and feed-based biofuels such as proposed RED II

Proposed changes in implementation agenda questionnaire for the next triennium

- Collect information on the trade of biofuels in member countries (domestic production, domestic use, exports, imports and tariffs)
- Focus report into regions (e.g., Europe, Asia, North and South America, Australasia, Africa)
- Evaluate which types of policies - carbon tax, low carbon fuel standard, mandates, etc. - work best?
- Develop an online tool mapping the existing policies in member countries
- **Other suggestions??**

Conclusions

- Policy is still the primary driver for the production and use of biofuels.
- Biofuel blending mandates is still the primary biofuels policy tool
- The success of the LCFS in California and British Columbia has led to many states and even other countries looking to adopt similar programs
- International, national and regional GHG reduction goals has shifted the attention from blending mandates to the carbon intensity of biofuels.
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Additional slides

Biofuels production on a global scale

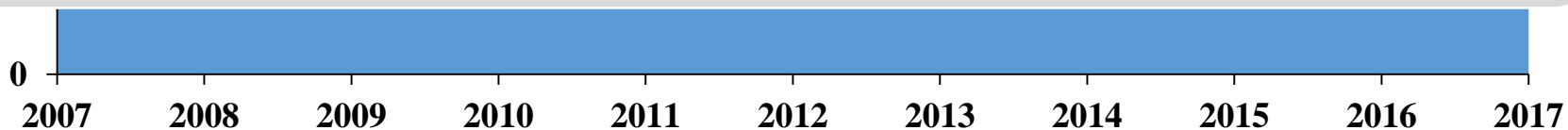
Biofuels production has continued to increase from over 37 million tonnes oil equivalent produced in 2007 to over 84 million tonnes oil equivalent in 2017. It increased 3% from 2016 to 2017, well below the annual growth rate of 9% over the past decade, however, the most growth in three years.



The highest growth rate was observed in Asia Pacific with an annual growth rate of 20.1% over the period of 2006-2016 and a 6% increase in 2017 compared to 2016.



North America, South and Central America and Europe still have the highest share of biofuels production in 2017, at 45.5%, 26.9% and 16.8%, respectively.



Biofuels production on a global scale

Top ten biofuels producer countries in 2017

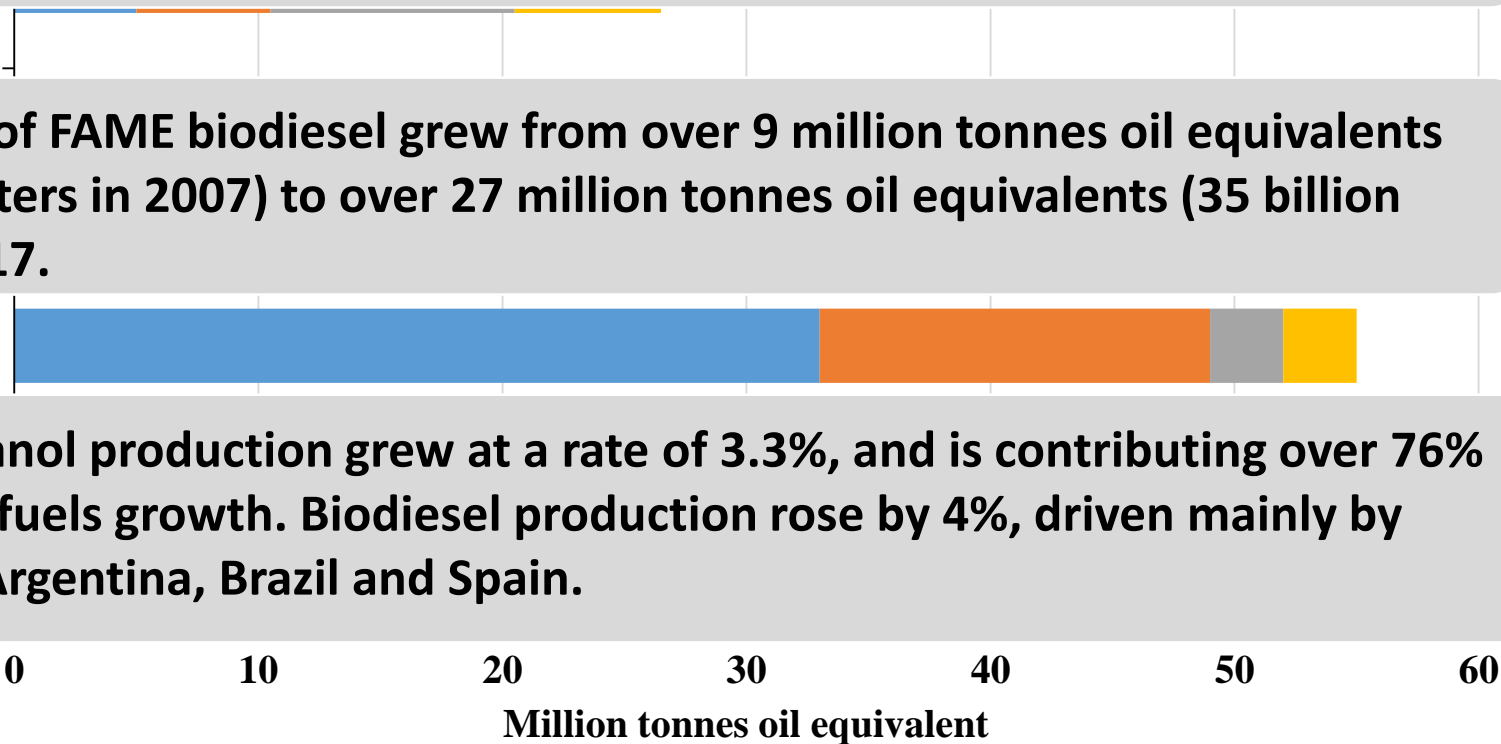
Country	Biofuels production (million tonnes oil equivalent)	Share in 2017
US	36,936	43.9%
Brazil	18,465	22.0%
Germany	3,293	3.9%
Argentina	3,131	3.7%
Indonesia	2,326	2.8%
France	2,224	2.6%
China	2,147	2.6%
Thailand	1,846	2.2%
Netherlands	1,658	2.0%
Spain	1,541	1.8%

Biofuels production on a global scale

The total worldwide production of ethanol increased from 29 million tonnes oil equivalent (60 billion liters) in 2007 to 55 million tonnes oil equivalent (114 billion liters in 2017)

Production of FAME biodiesel grew from over 9 million tonnes oil equivalents (11 billion liters in 2007) to over 27 million tonnes oil equivalents (35 billion liters) in 2017.

Ethanol 2017



Global ethanol production grew at a rate of 3.3%, and is contributing over 76% to total biofuels growth. Biodiesel production rose by 4%, driven mainly by growth in Argentina, Brazil and Spain.

Drop-in and advanced biofuels

- Most of the drop-in biofuels being produced today are made from oleochemical/lipid-rich feedstocks (i.e., hydrotreated vegetable oil (HVO) or hydroprocessed esters and fatty acids (HEFA)).
- Production is concentrated in Finland, the Netherlands, Singapore and the United States.
- Over 4 billion liters per year of such advanced HVO/HEFA biofuels are now being produced worldwide. A majority of these advanced biofuels are renewable diesel (RD = HVO/HEFA) and a small portion is biojet produced at AltAir's facility.
- These fuels are mainly sold in the markets such as California and British Columbia where LCFS policies are in force to incentivize biofuels based on their carbon intensity, or where there are other supporting policies based on GHG emission reductions such as Germany and Sweden.

Drop-in and advanced biofuels

- Currently, advanced biofuel production is at a low level and, even considering anticipated growth over the next five years, output is only expected to increase to around 1-2% of total biofuel production (1.5 to 3 billion L).
- The most evident progress is being made in the production of 1.5G and 2G cellulosic ethanol, with a number of commercial-scale plants constructed and working to scale up production.
- Several aviation biofuel production processes are already certified to industry standards. However, regional supply chain development and actions to reduce cost premiums over conventional jet fuels are needed.
- Biofuel consumption remains limited in the marine transport sector due to high cost premiums over bunker fuel and the need to build supply chains

Expected trends in biofuels market

- Most of the market growth is expected to come from Latin America and non-OECD Asian countries.
- China intends to roll out 10% ethanol blends in gasoline nationwide. This would require a six-fold increase in output to meet demand, and has led to new investment in ethanol production capacity.
- In Brazil, the drivers for biofuel demand remain strong and the new RenovaBio policy is anticipated to facilitate investment to increase biofuel production capacity.
- The growth prospects for conventional biofuels production in the European Union and the United States are more limited.
- Demand for HVO/HEFA fuels is expected to grow mainly because of the “drop-in” properties of these fuels but feedstock security and price is a major challenge.
- Production of advanced biofuels from non-food crop feedstocks is anticipated to remain modest in the short term.