2018 Glycerine Structural Shift

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AGENDA

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    - Soap
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  - Regional
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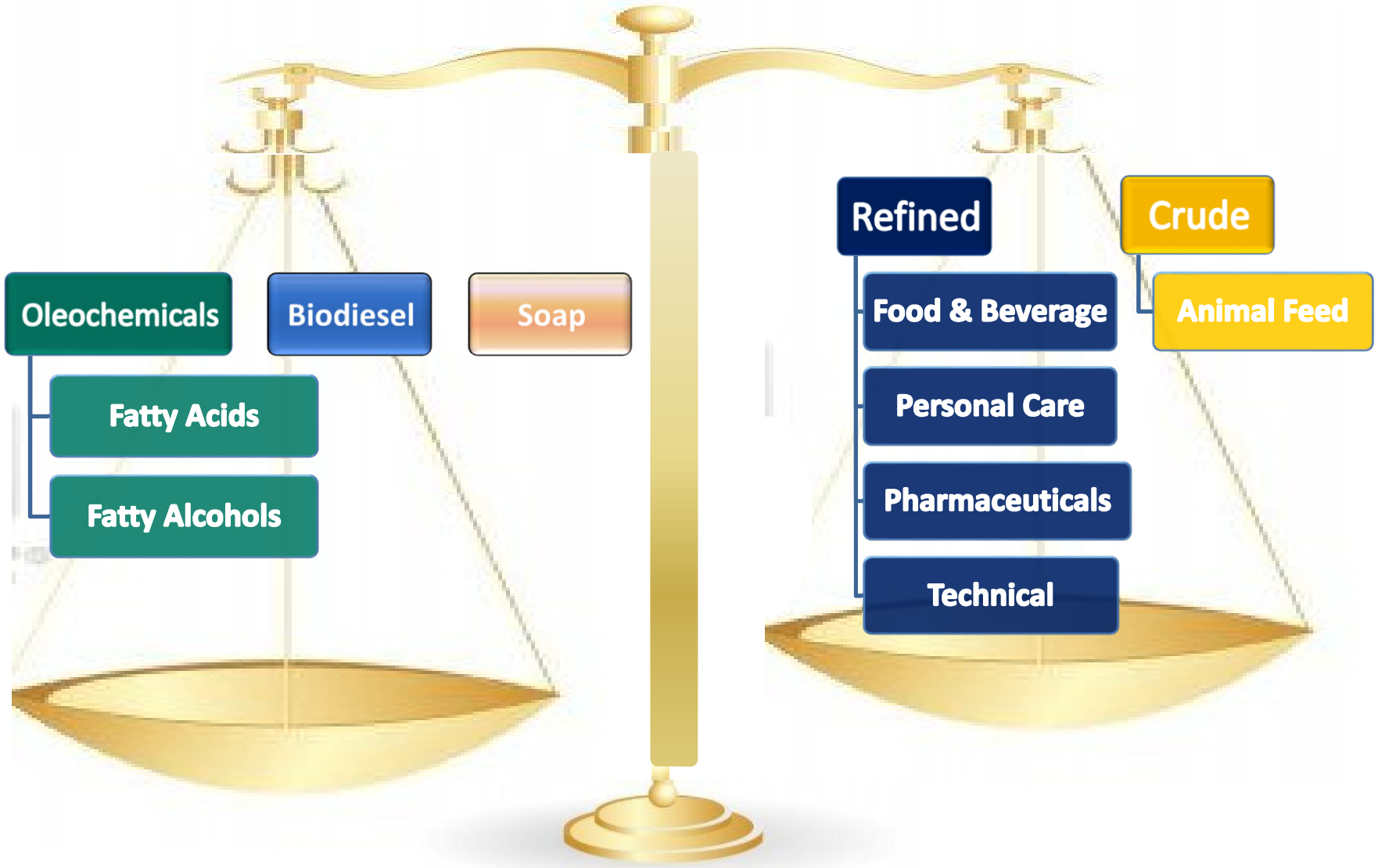
- US Glycerine Supply-Demand Balance
- Refined Demand
  - By Region, Focus on Americas
  - By Application
    - Traditional
    - Substitution
  - China Impact
- Regional Price Trends

Glycerine Balance

Supply

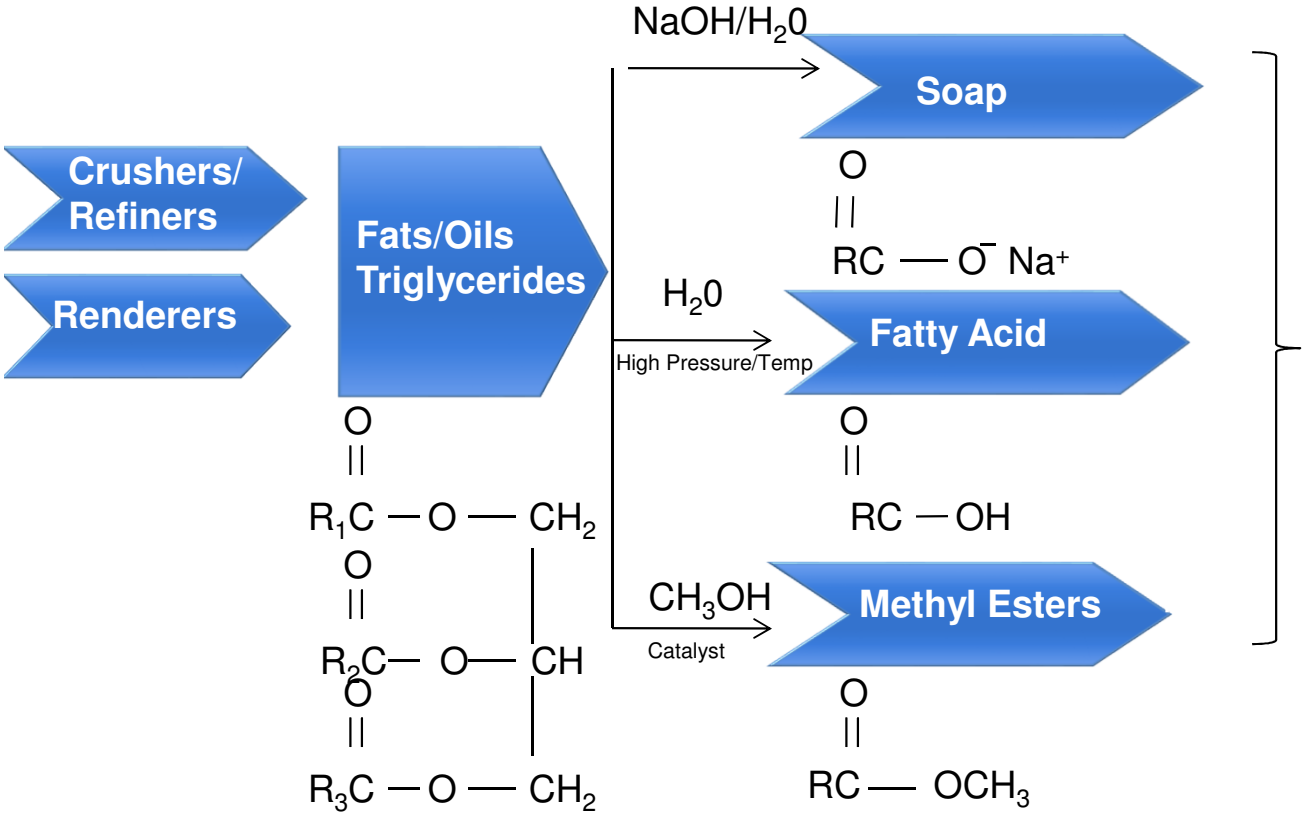
2018

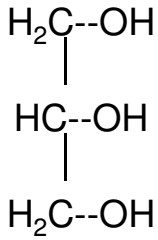
Demand



Vantage

Natural Glycerine
Supply Side Drivers



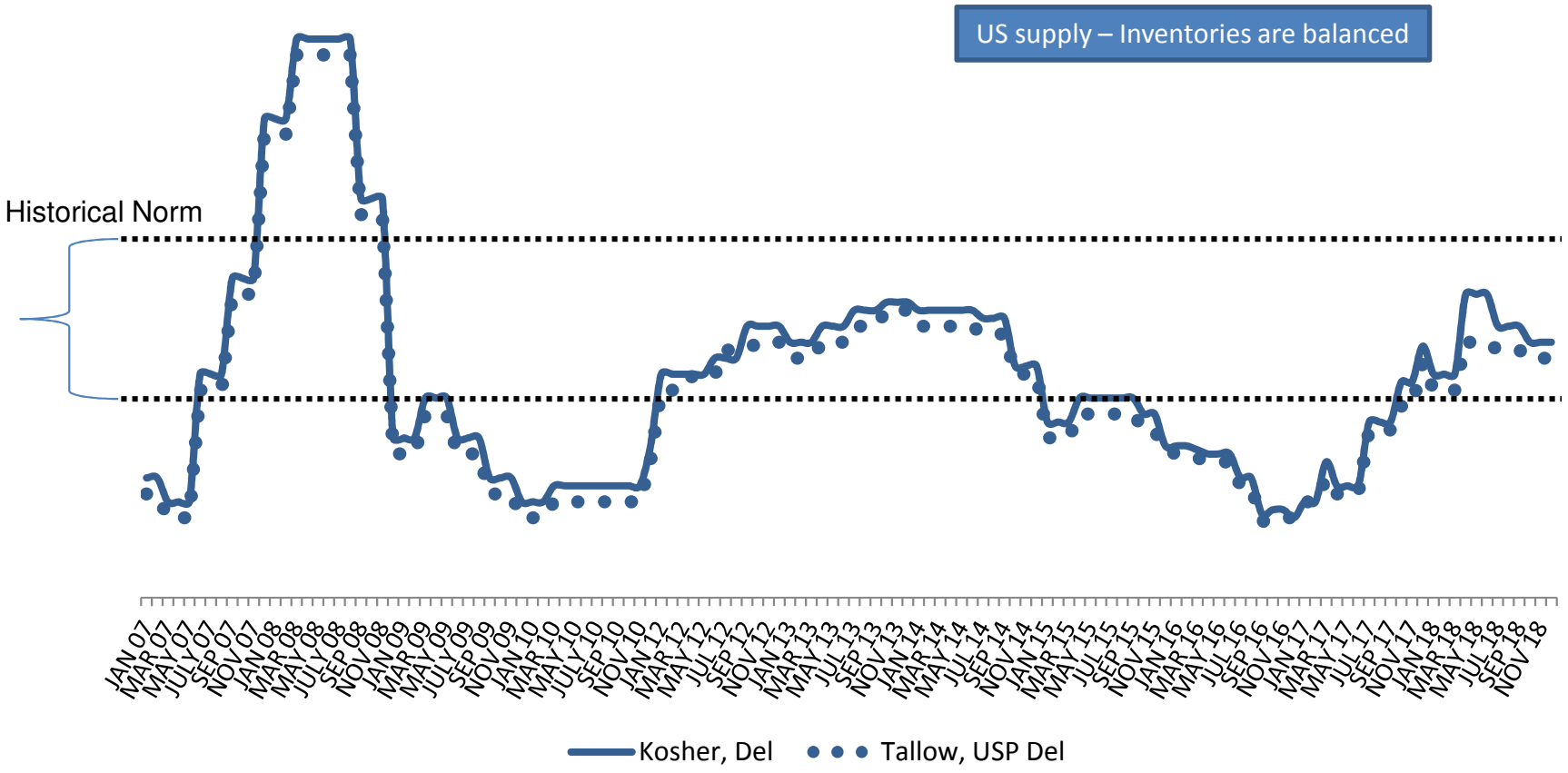


Glycerine

- Cost Fats & Oils
- Price Diesel
- Legislative Policies
- Demand for Oleochemicals/Soap
- Regional Refining Capacity

R= Alkyl (C8 – C20)

Historical US Market Price, Refined Glycerine

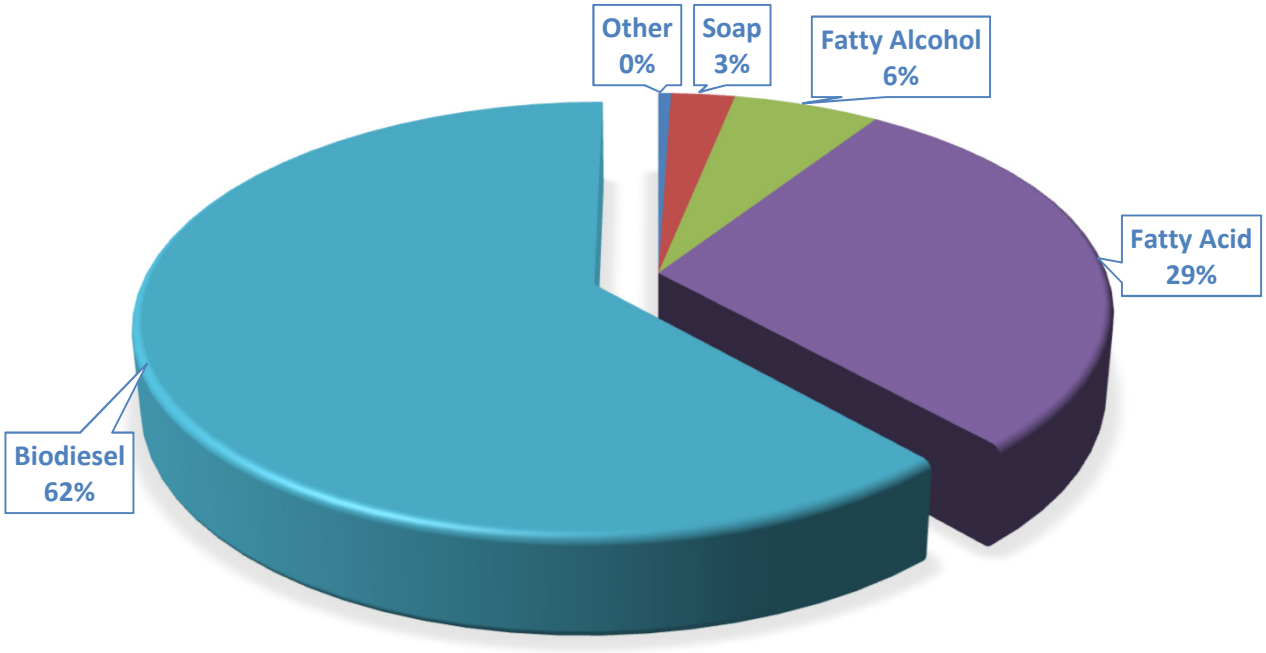


Source: Oleoline Delivered (Ave)

Ave Freight = 6 cents

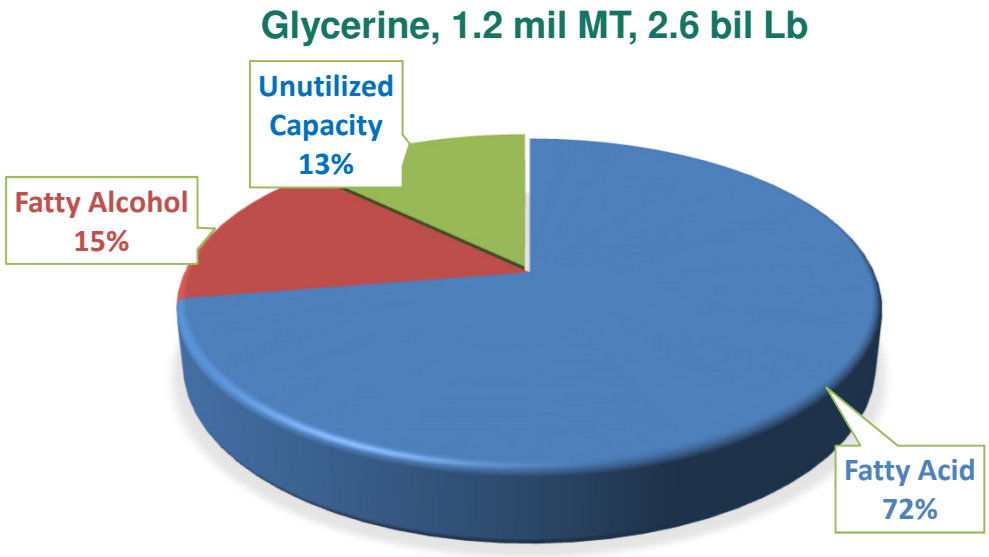
Global Crude Glycerine Supply by Industry, 2018F

3.8 mil MT, 8.4 bil Lb



Source: LMC 2018 Glycerine Report, IHS, Oleoline

Global Crude Glycerine Oleochemicals, 2018F



Oleochemical Capacity: 13.8 mil MT

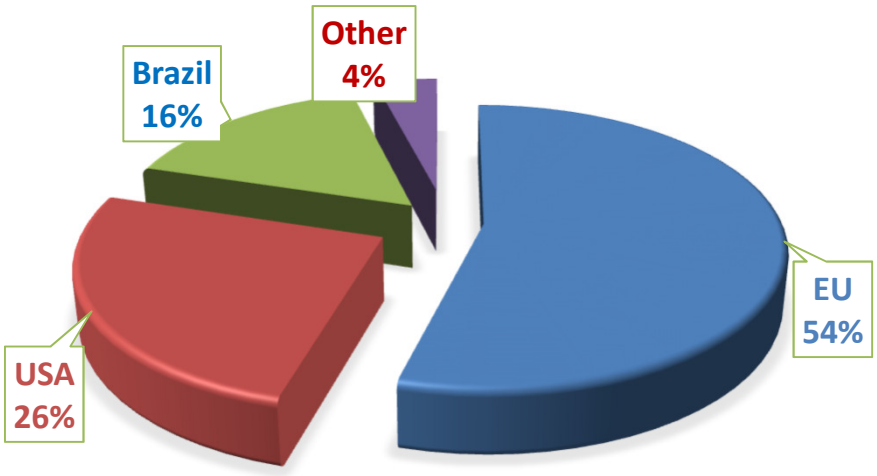
Production: 12 mil MT

The primary growing source of glycerine going forward will come from oleochemicals to support rapid demand growth in Asia (China and India).

Total crude glycerine supply by end 2018 ≈ 8.4 billion pounds

Source: Oleoline; IHS; Frost & Sullivan; LMC; Market Knowledge

Global Biodiesel Consumption 2018F, 24.7 Million MT, 54.55 Bil Lb



Europe and US consume ≈ 80%

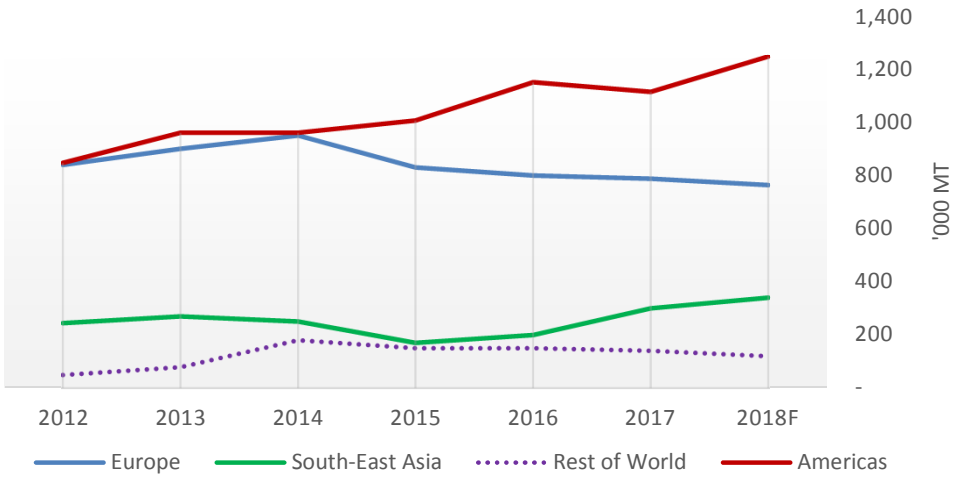
Europe, Malaysia, Argentina, Indonesia all chasing the same EU Market share.

Source: Oleoline; IHS; Frost & Sullivan; LMC; Market Knowledge

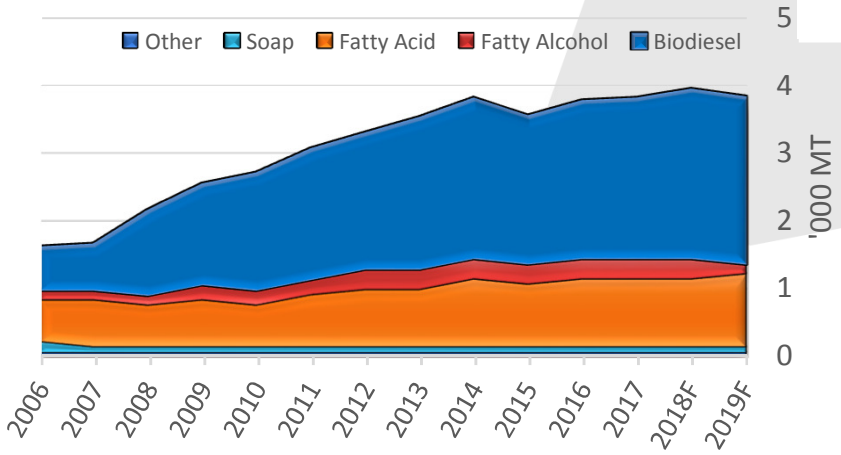
Global Crude Glycerine Supply 2018F

3.8 mil MT, 8.4 bil Lb

Glycerine from Biodiesel by Region



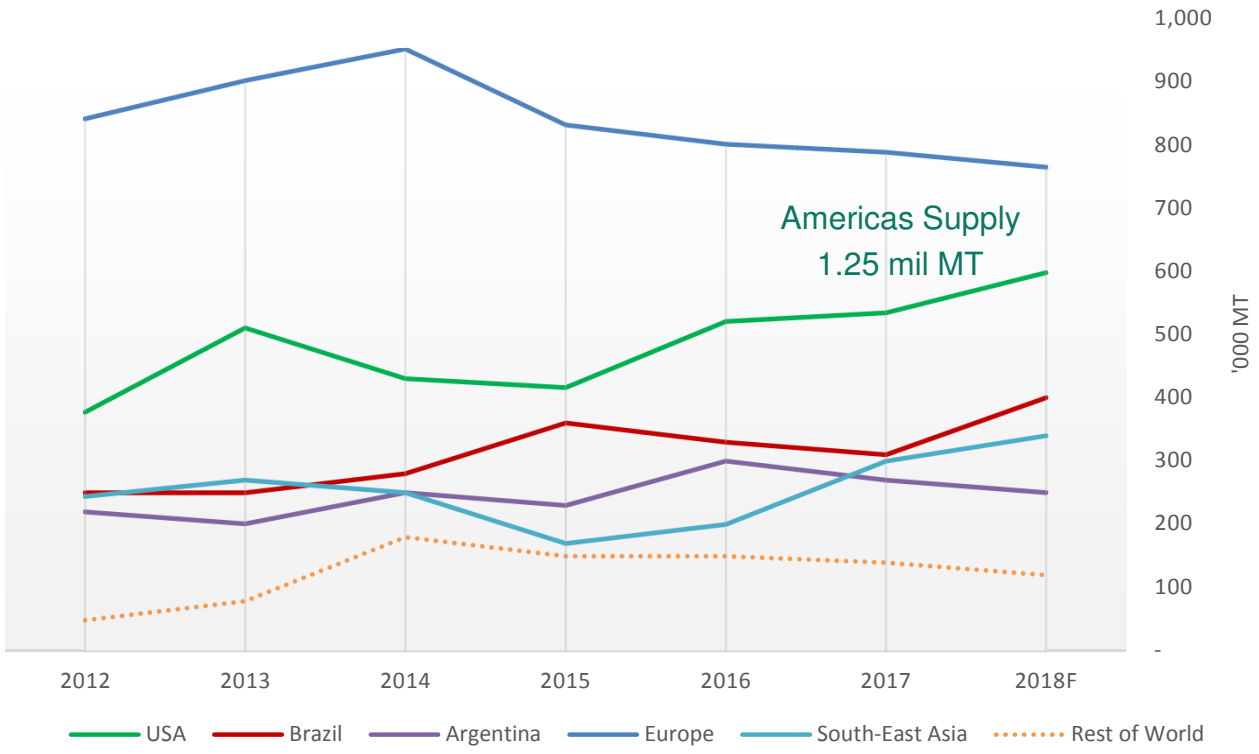
Glycerine Production by Industry



Structural Shift
Europe to Americas

Source: Oleoline; IHS; LMC; Market Knowledge

Crude Glycerine from Biodiesel by Region



Brazil and US produce BBD to fulfill domestic mandates.

Argentina and SE Asia produce primarily for export.

[Biodiesel exports from Argentina: uncertain pending EU AS Ruling]

Source: Oleoline; IHS; LMC; Market Knowledge
BBD = Biomass Based Diesel; AS= Antisubsidy

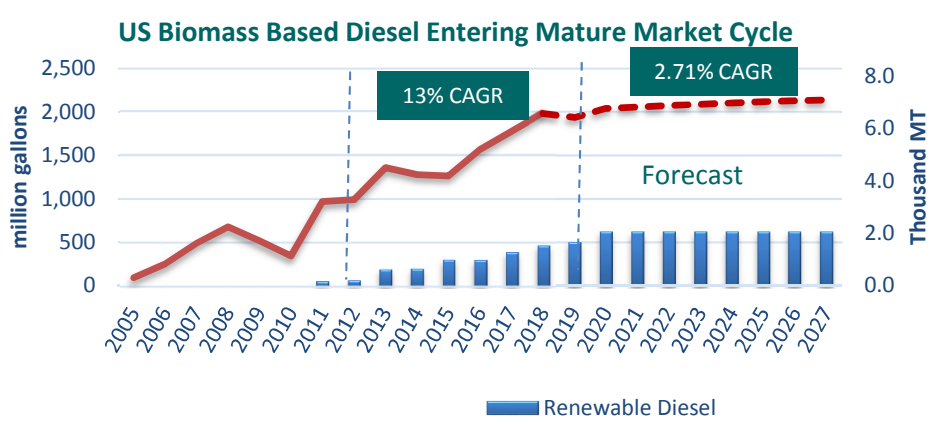
Glycerine Market

Structural Shifts: Technology

Europe and Americas

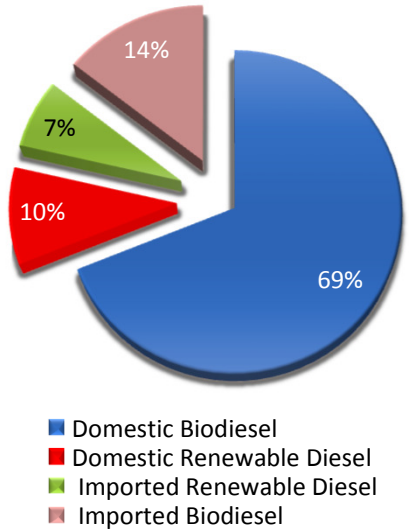
US Biomass Based Diesel

- 2.6 bil gal produced 2017 (US and Import)
- 2.1 bil gal mandate; limiting Q1 production.
- Tax credit retroactive 2017; no 2018 BTC.



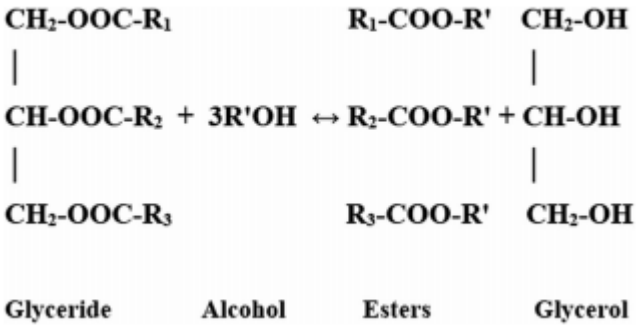
Source: FAPRI 2018 Longterm Projections, EPA RFS, EIA

2017
8.5 million MT
18.6 bil Lb./ 2.6 bil gallons*

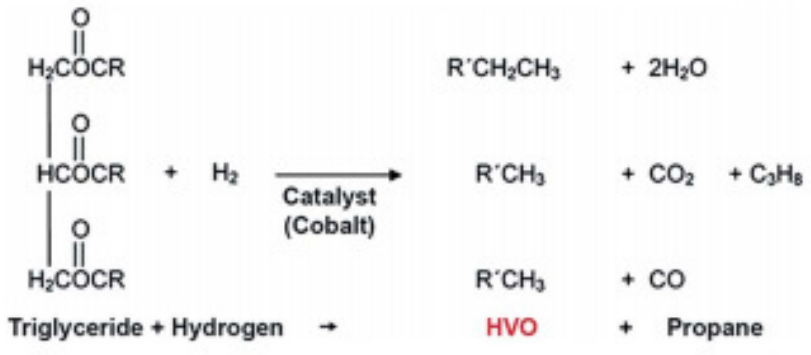


- US market matures and stabilizes
- Mandates: 2.1 bil gallons 2017, 2018, 2019
- Import tariffs protect producers through 2022
- ≈ 21% US BD/RD is imported.

HVO Process



Trans-esterification process: "biodiesel" production



Hydrogenation process: HVO production

- The trans-esterification (methyl ester) process yields crude glycerine.
- The growth in popularity of Renewable Diesel/HVO and co-processing could mean a reduction in glycerine supply. This process does not yield glycerine and is chemically identical to diesel.

Source: Royal Society of Chemistry Journal

Global Legislative Implications

Glycerine Impact
2016-2017: -1.4 bil Lb
2018-2020: -2.2 bil Lb

- Indonesia: Tariffs lifted in EU; Tariffs imposed US.
- Argentina: Tariffs lifted in EU; new EU lawsuit filed, Anti-subsidy. Tariffs imposed US.
- US BTC: 2017 only; 2018, 2019 not extended.
- China demand appears to resume.

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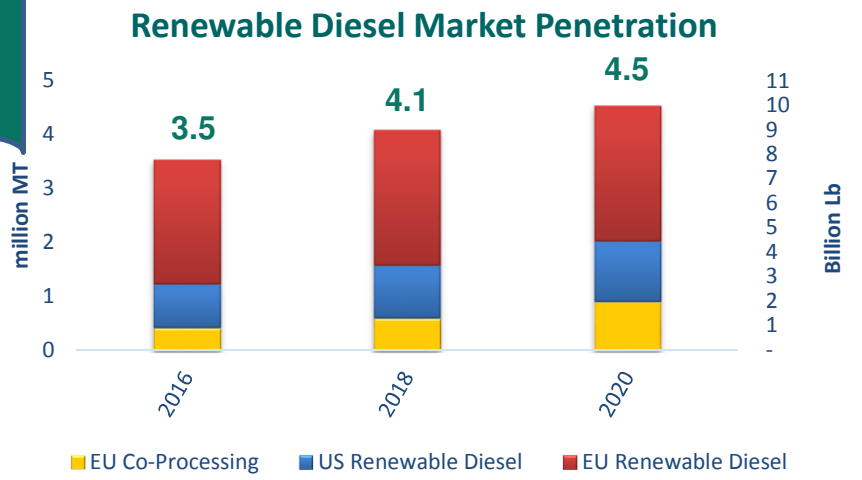
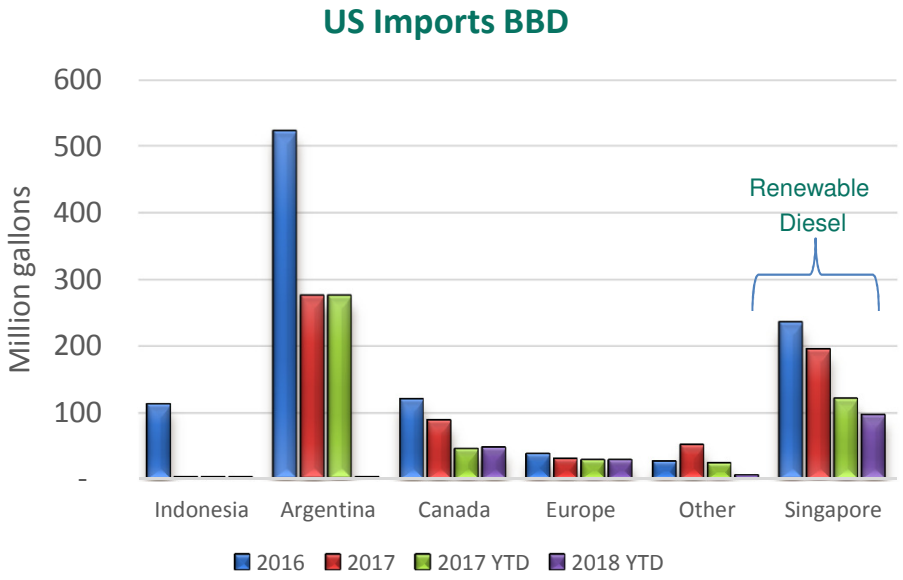


- EU BD market cycle is declining.
- EU will not support food oil BD/RD after 2020.
- EU trend to RD & coprocessing yields no glycerine.
- EU double counting consumes 2.9 MM MT FAME.
- Germany has moved to GHG scheme.

Double Counting
Veg Glycerine Impact
-640 MM Lb

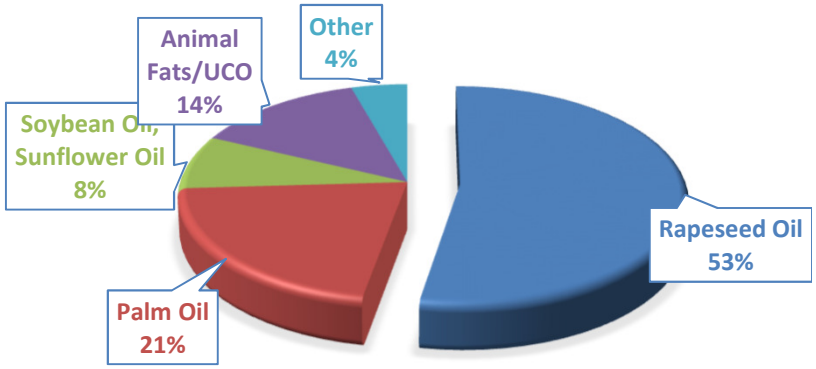


Global structural changes impact vegetable glycerine supply by 1 mil MT (2.2 billion Lb)

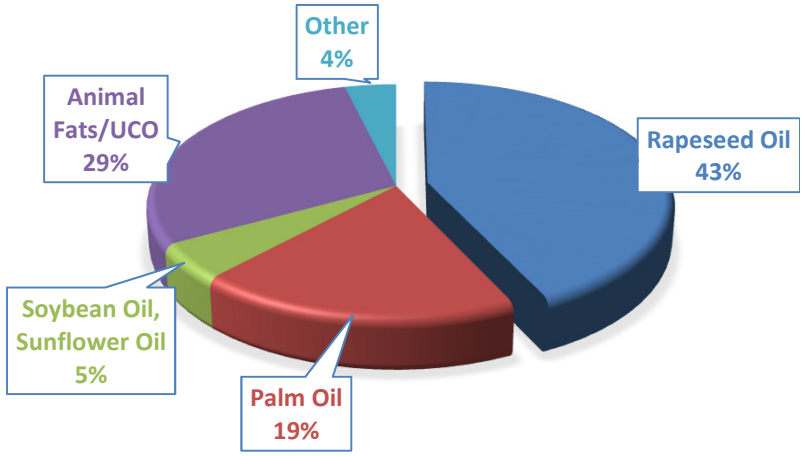
BBD= Biomass Based Diesel
BD = Biodiesel; RD = Renewable Diesel

EIA (Energy Information Administration); Oleoline; NESTE Annual Report
USITC (US International Trade Commission); Market Knowledge

EU Feedstocks
Biomass Based Diesel Europe



11.2 million MT
2013



14.3 million MT
2018F

Double counting and renewable diesel are replacing est 3.7 MM MT EU biodiesel.

Double counting is when Used Cooking Oil or PFAD are used as feedstocks; petrol companies can use ½ mandate requirement.

Source: FAS EU 28 Biofuels Annual July 2018

New Players in HVO

Source : Greenea. Current and planned HVO production units.

Company	HVO capacity, 2018	
	'000 MT	Bil Lb
NESTE	2,500	5.5
Total Petrol	500	1.1
ENI	300	2.0
UPM	100	.55
Diamond Green	900	2.0
REG	250	.55
TOTAL	4,550	10.0

Glycerine Impact: 455 kte (1 billion Lb)

- NESTE >50% > HVO market share.
- Total refinery commissioning Summer 2018.
- Diamond Green expansion, Aug '18: 1.2 bil Lb ➔ 2.0 bil Lb

Glycerine Demand Drivers

Substitution (Glycols)

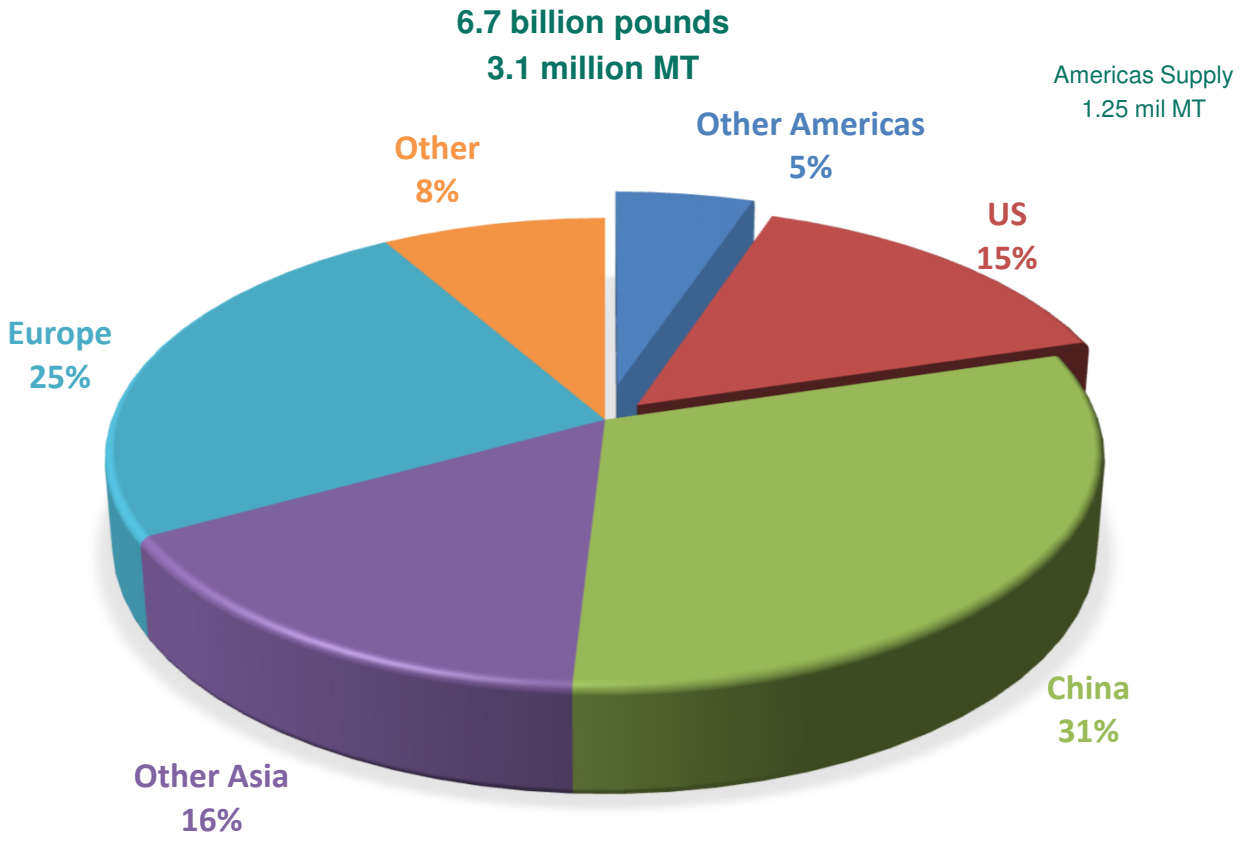
Growing Applications

New Technology

Propylene Glycol

GREEN EPICHLOROHYDRIN

Global Refined Glycerine Demand by Region 2017

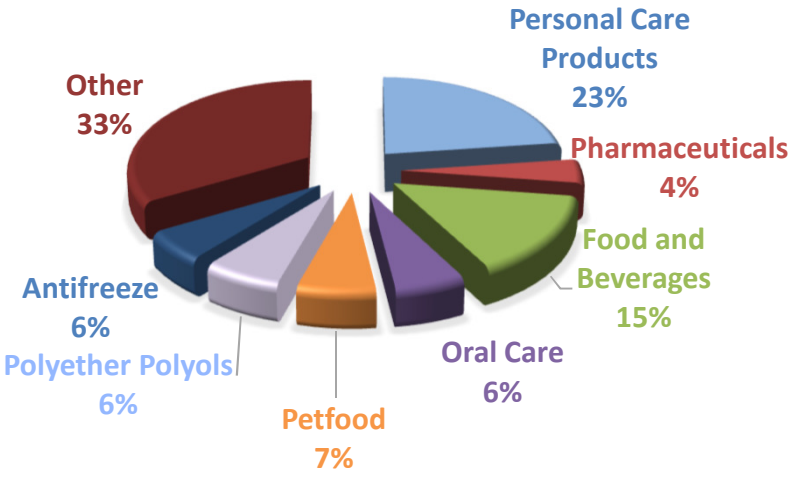


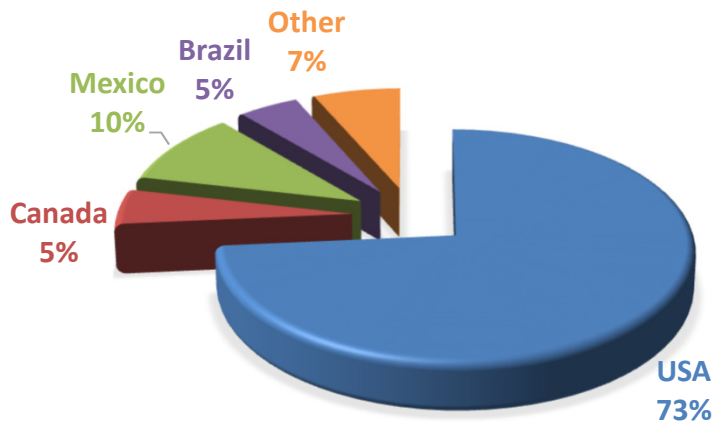
Americas: 20% of Global Demand
≈ 620 kte (1.4 bil Lb)

HBI; HIS; LMC; Market Knowledge
Kte = thousand metric tons

Refined Glycerine Demand Americas 2017

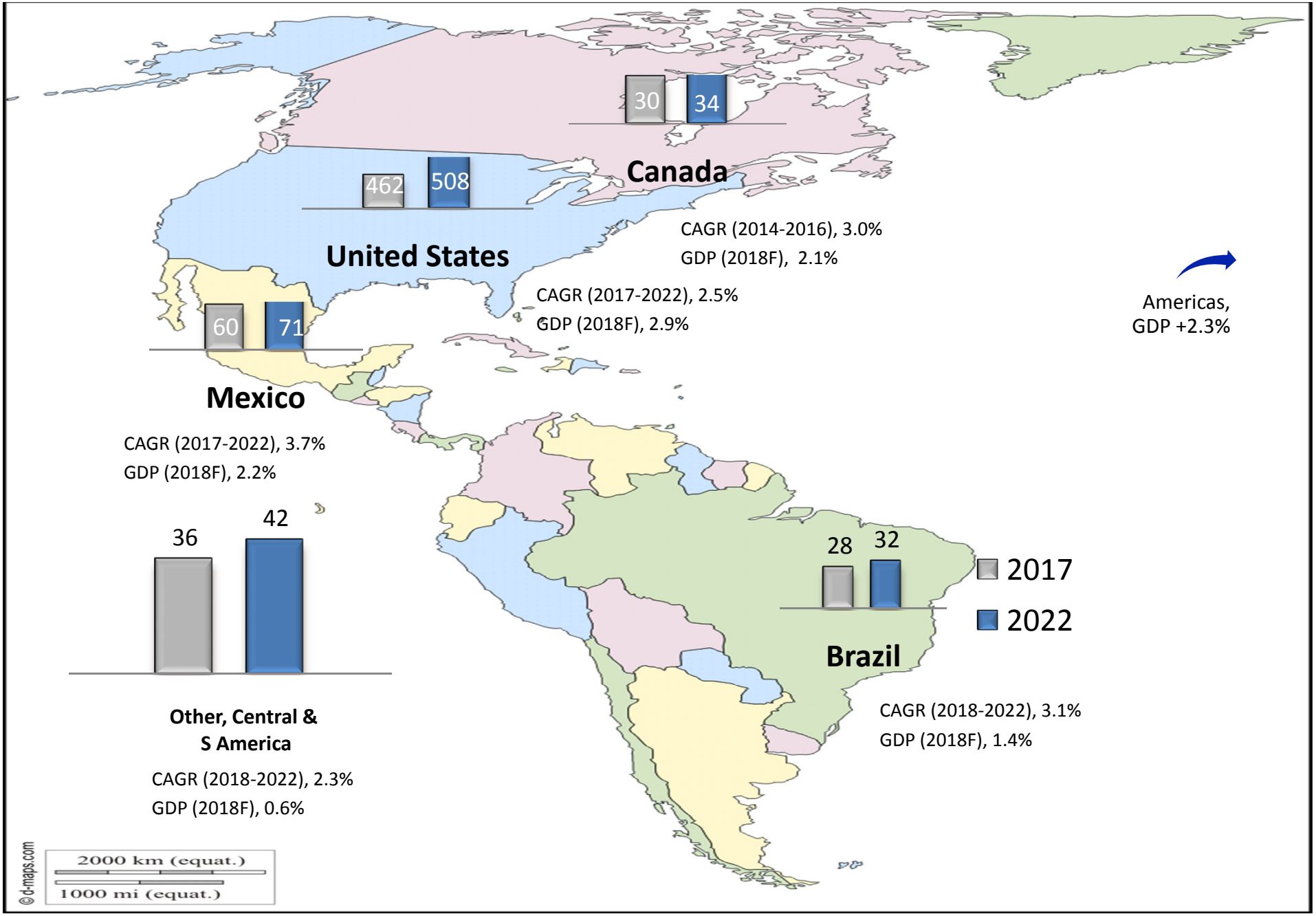
Americas Supply
1.25 mil MT





620 thousand MT (1.4 bil Lb)

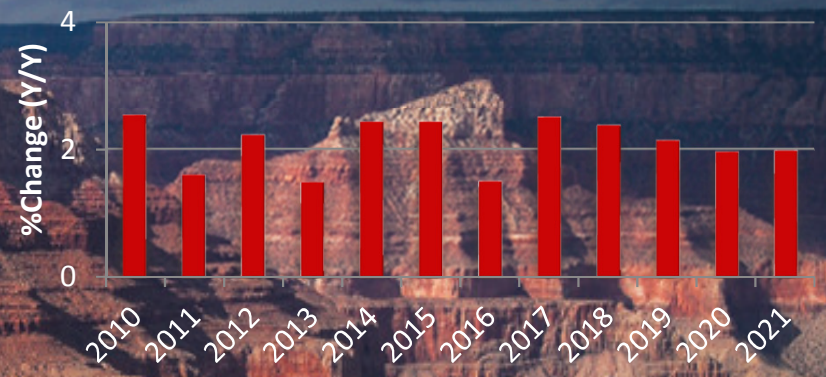
Source: IHS, Frost & Sullivan and Market Knowledge



Source: World Bank, CEH, Frost & Sullivan, Vantage Estimate

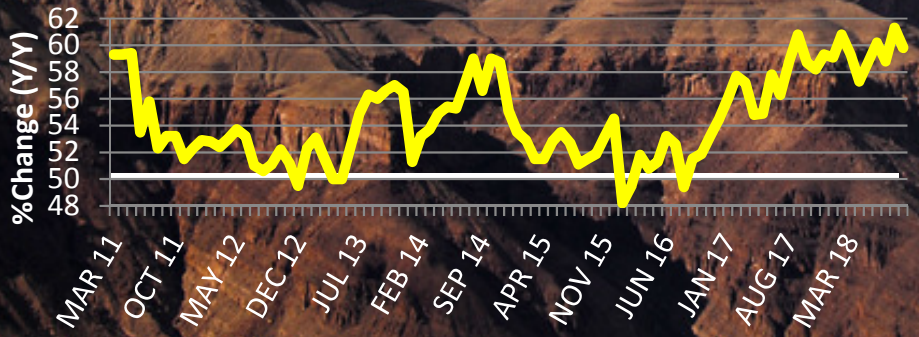
USA

GDP Growth



Source: IMF

Manufacturing PMI

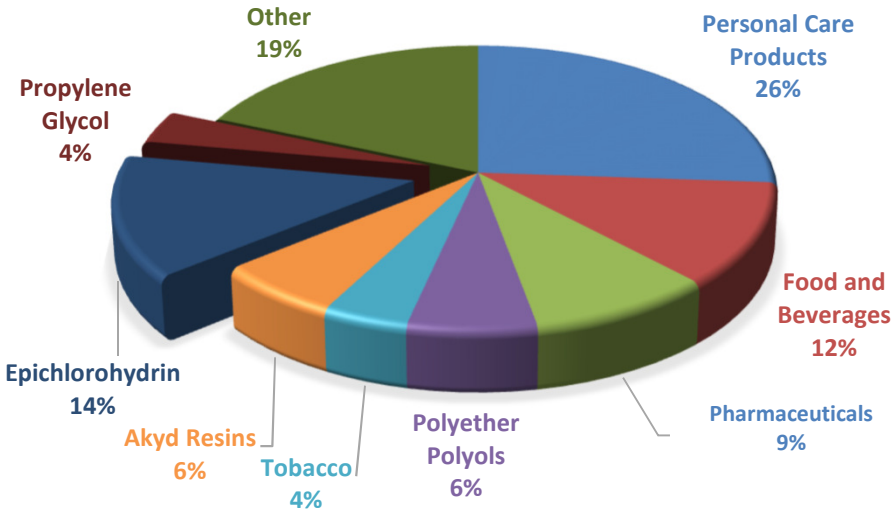


Source: Institute of Supply Management

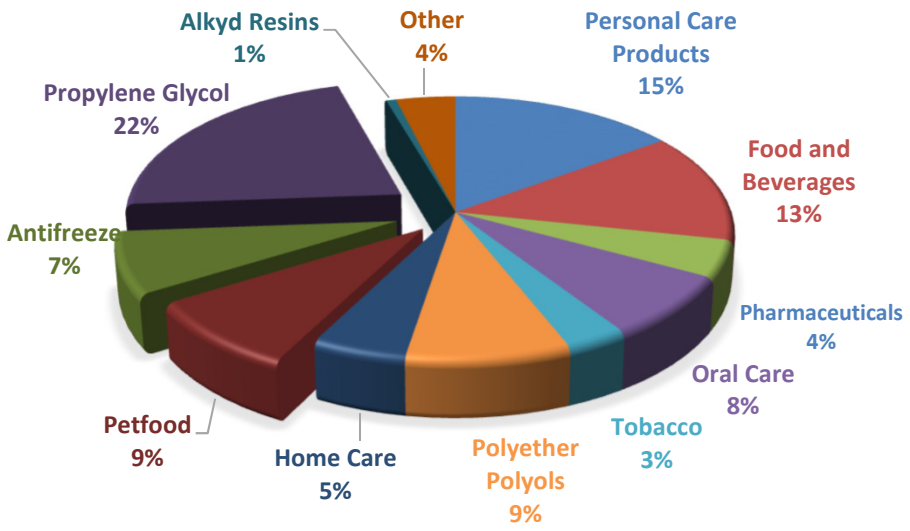
Global vs US Refined Glycerine Demand by Application

3.1 million MT, 6.7 billion Lb

GLOBAL
3.1 MIL MT



US
462 KTE



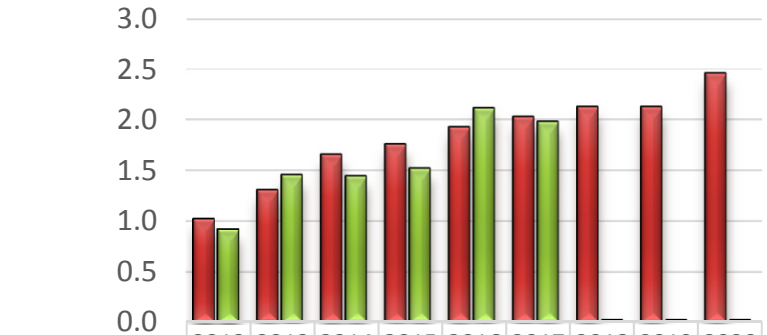
18% of refined glycerine consumption is from new applications; +560 kte (1.2B pounds) vs 2013). Substitution applications will be sensitive to price.

Vantage

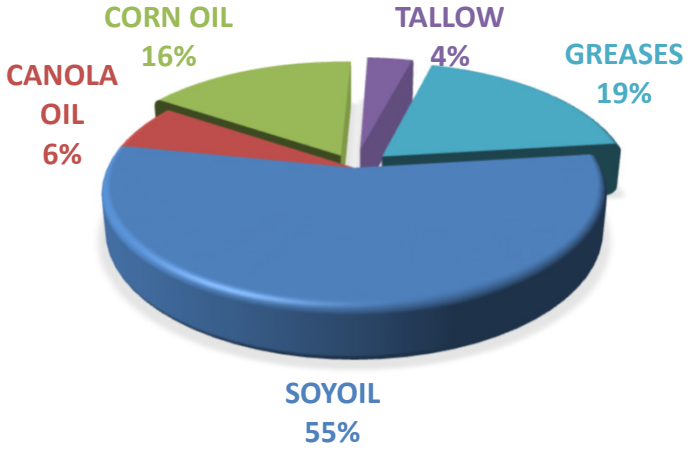
Source: LMC, IHS; Market Knowledge

US Glycerine Supply

US Fats and Oil Consumption
Biodiesel 2018 [1] (12.4 billion Lb; 5.6 MM MT)



	2012	2013	2014	2015	2016	2017	2018	2019	2020
Mandate	1	1.28	1.63	1.73	1.9	2	2.1	2.1	2.43
Consumption	0.9	1.4	1.4	1.5	2.1	2.0	-	-	-



- Oleochemical supply is stable vs robust demand.
- Biodiesel consumption ≈ Mandates
- ≈60% yields kosher crude quality glycerine.
- ≈40% ⟶ feed, deicing, export.
- Feedstocks are balanced.
- Vertically integrated production is sustainable without a tax credit.

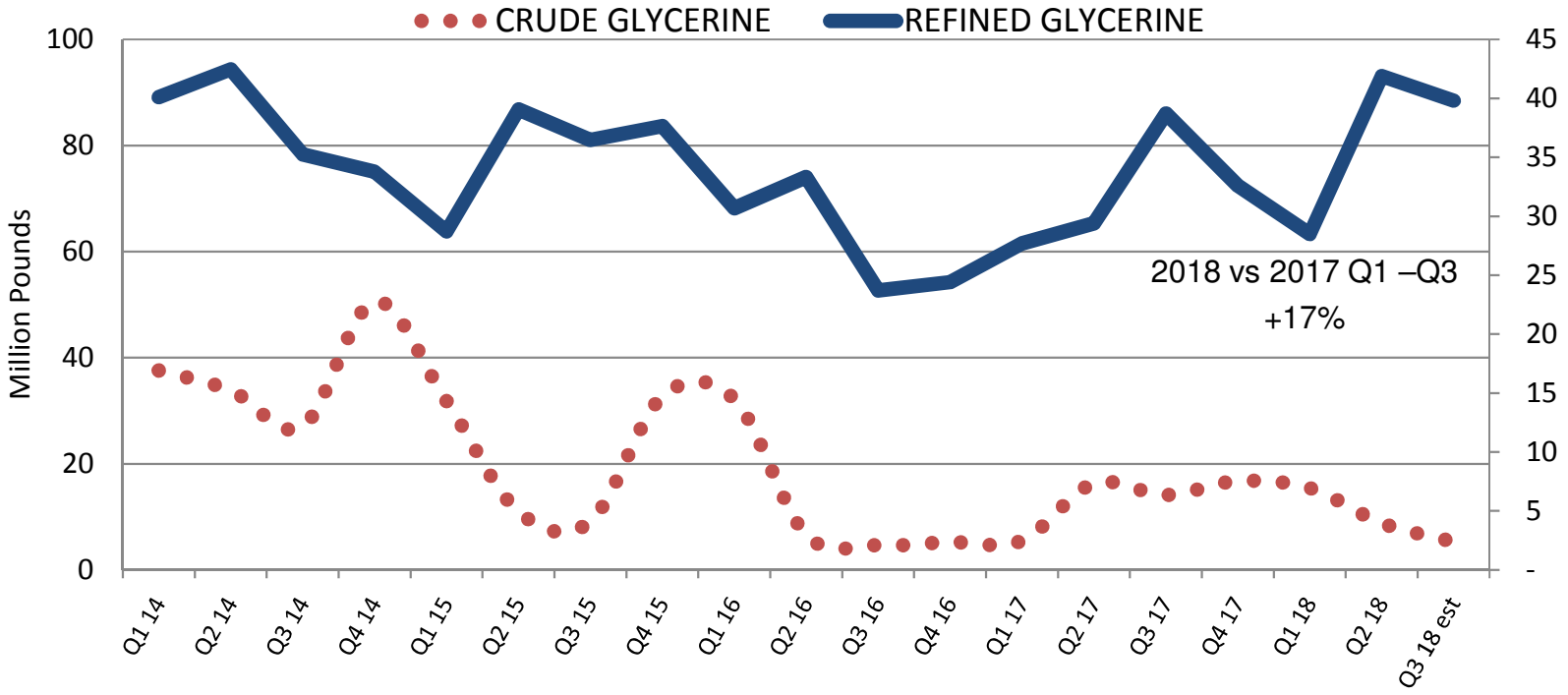
	Jan-July 2018 *million Lb*	Est 2018 FY *million pounds*	2017 *million pounds*	% of Supply	Primary Application
Soyoil	3,978	6,819	6,230	≈31	Food
Canola Oil	631	768	1,452	≈8	Food
Corn Oil	673	2,005	1,579	≈70	Animal Feed
Tallow	191	433	374	≈11	Animal Feed & Oleo/Soap
Greases	1,226	2,341	2,235	≈30	Animal Feed

Source: EIA Monthly Biodiesel Production Report; USDA

Corn Oil: Distillers grain corn oil

[1] 2018 FY based on Jan-July and historical seasonality vs mandate.

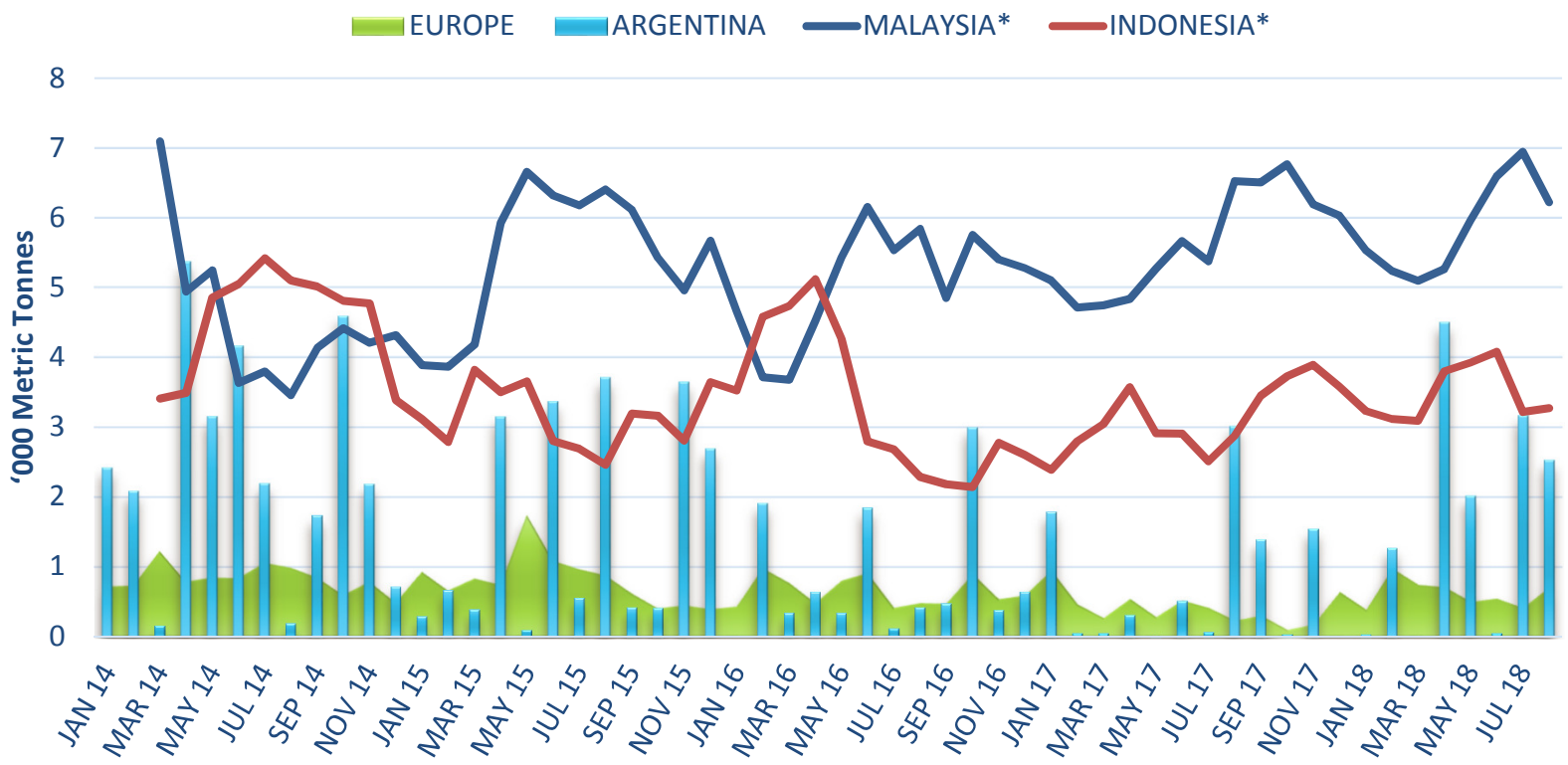
US Crude and Refined Glycerine Imports
2013 – 2016 Q1-Q3



Imports of crude and refined 2018 Jan-August:
Imports remain at a robust pace to satisfy US increasing demand.

Source: US Harmonized Tariff System

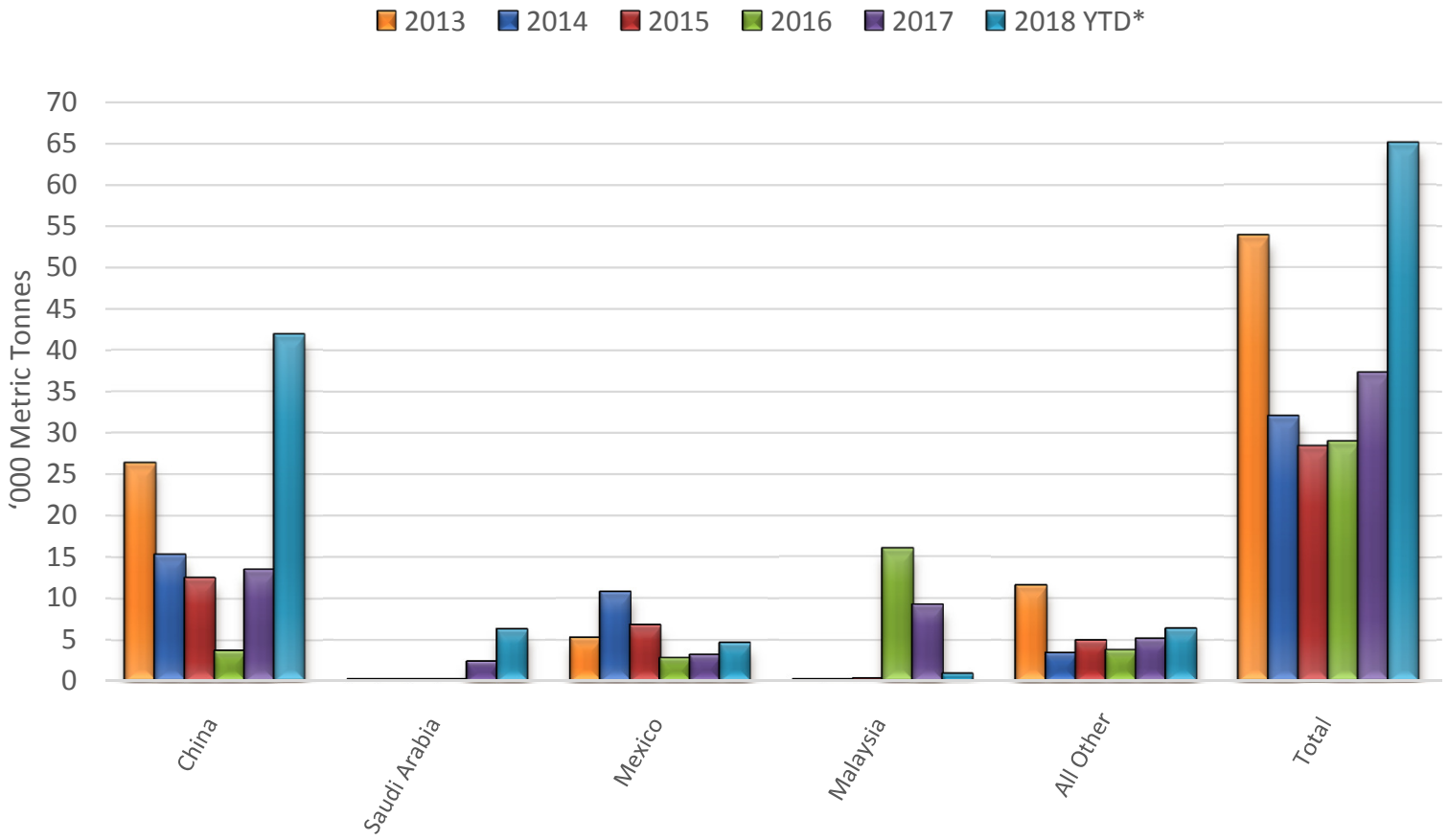
US Refined Glycerine Imports
2014 – 2018



Malaysia and Indonesia compete for US market share.
Argentina imports are supply driven.

Source: US Harmonized Tariff System

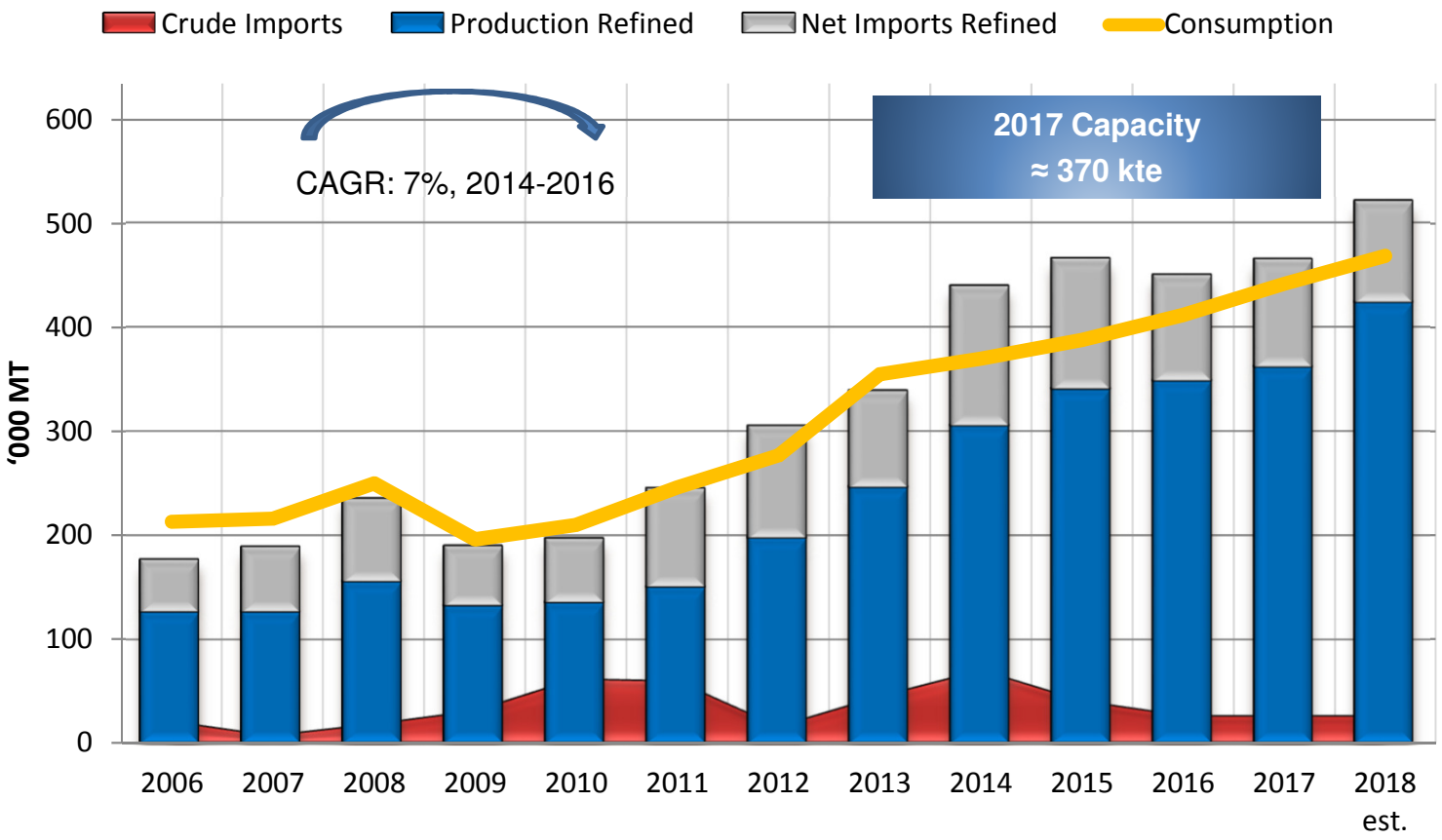
US Crude Glycerine Exports



Crude glycerine exports: Market diversification is beginning.

Source: US Harmonized Tariff System

US Glycerine Supply –Demand



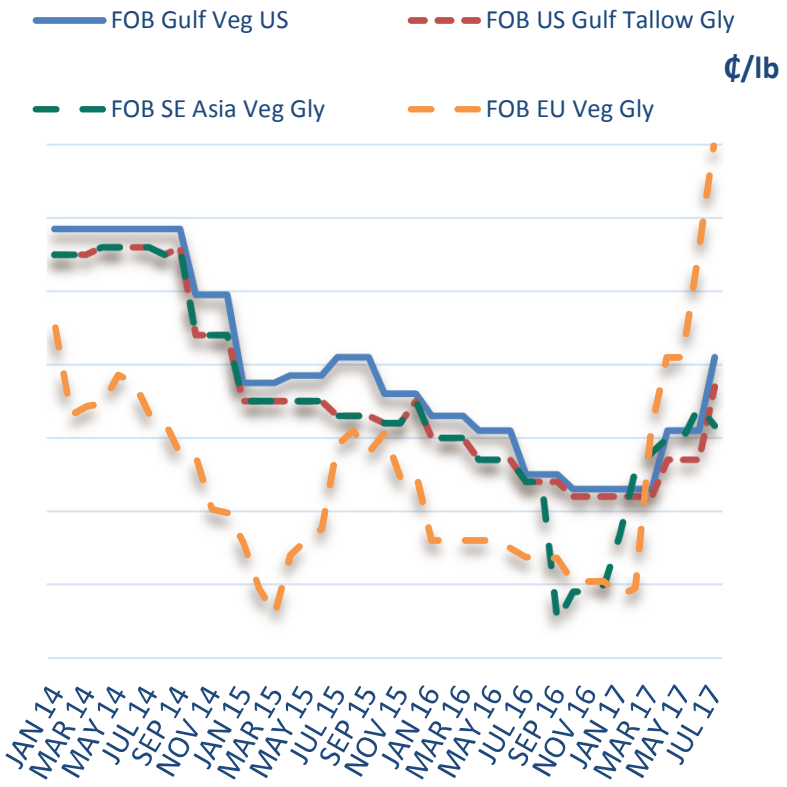
US consumption >70% Vegetable/Kosher

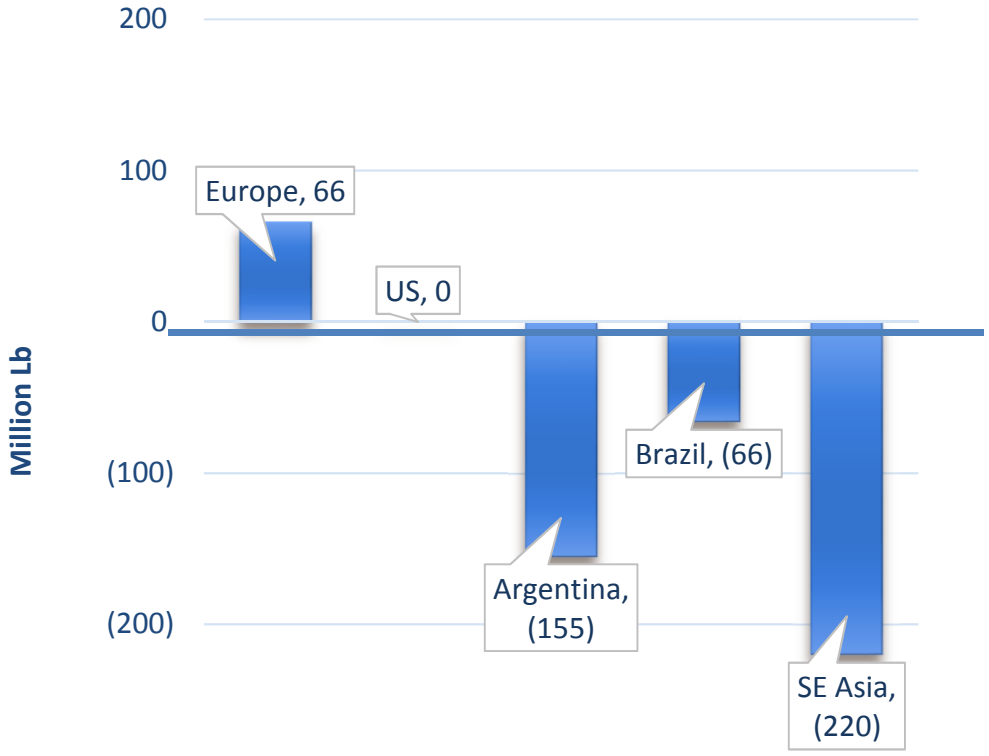
Kosher crude glycerine will continue to be imported.

Refined glycerine will be rationalized as capacity is built.

Source: Oleoline; IHS; Market Knowledge

2017F vs 2016 Actual
Crude Glycerine from Biodiesel



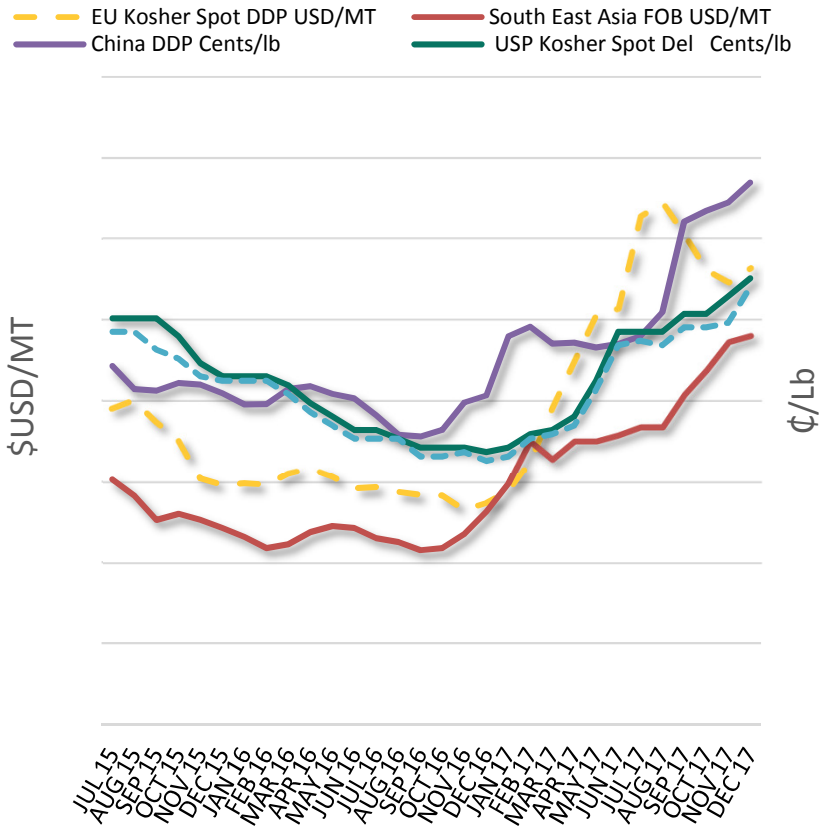


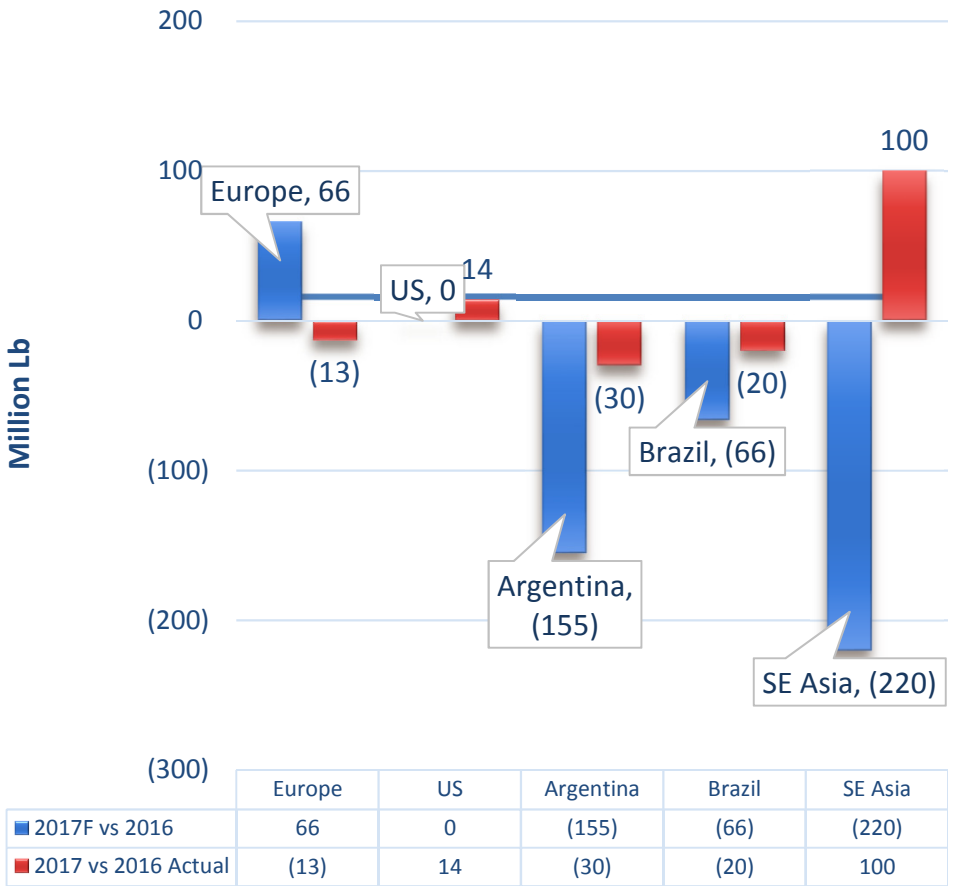
	Europe	US	Argentina	Brazil	SE Asia
2017F vs 2016	66	0	(155)	(66)	(220)

Δ 2017F vs 2016 ≈ -375 MM Lb

Source: Oleoline; USDA GAIN Reports; EIA; EPA RFS;

2017 vs 2016 Actual
Crude Glycerine from Biodiesel





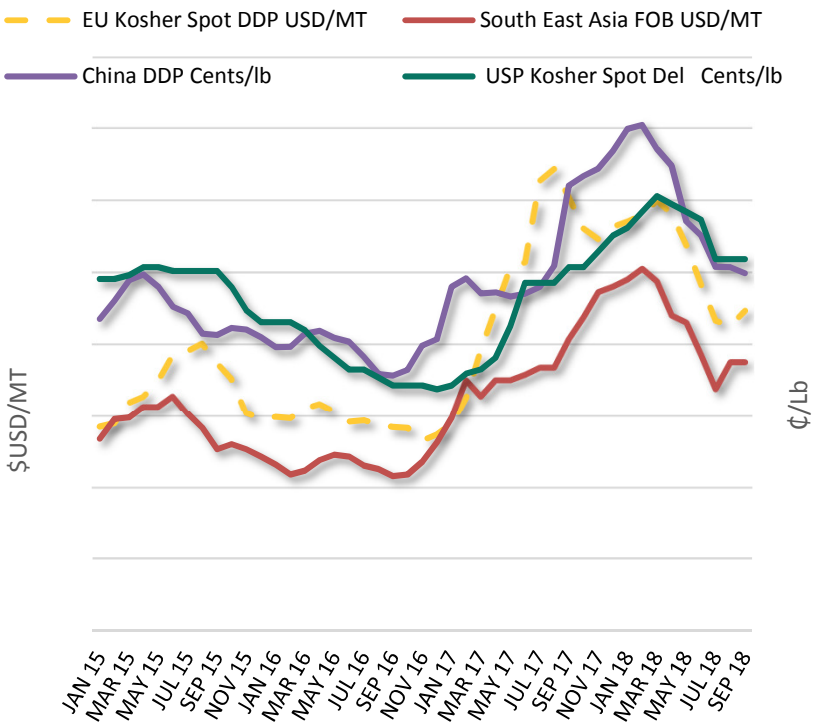
	Europe	US	Argentina	Brazil	SE Asia
2017F vs 2016	66	0	(155)	(66)	(220)
2017 vs 2016 Actual	(13)	14	(30)	(20)	100

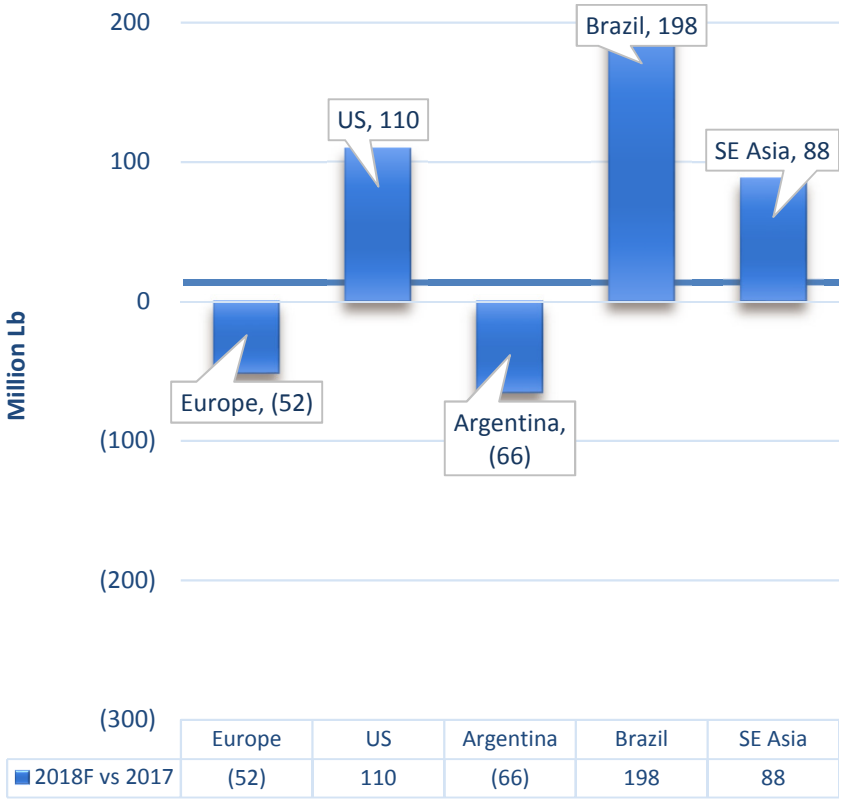
Δ 2017F vs 2016 ≈ -375 MM Lb

Δ 2017 vs 2016 ≈ +51 MM Lb

Source: Oleoline; USDA GAIN Reports; EIA; EPA RFS

2018F vs 2017
Crude Glycerine from Biodiesel





	Europe	US	Argentina	Brazil	SE Asia
2018F vs 2017	(52)	110	(66)	198	88

Δ 2018F vs 2017 ≈ +235 MM Lb

Primarily 1st half 2018

Source: Oleoline; USDA GAIN Reports; EIA; EPA RFS

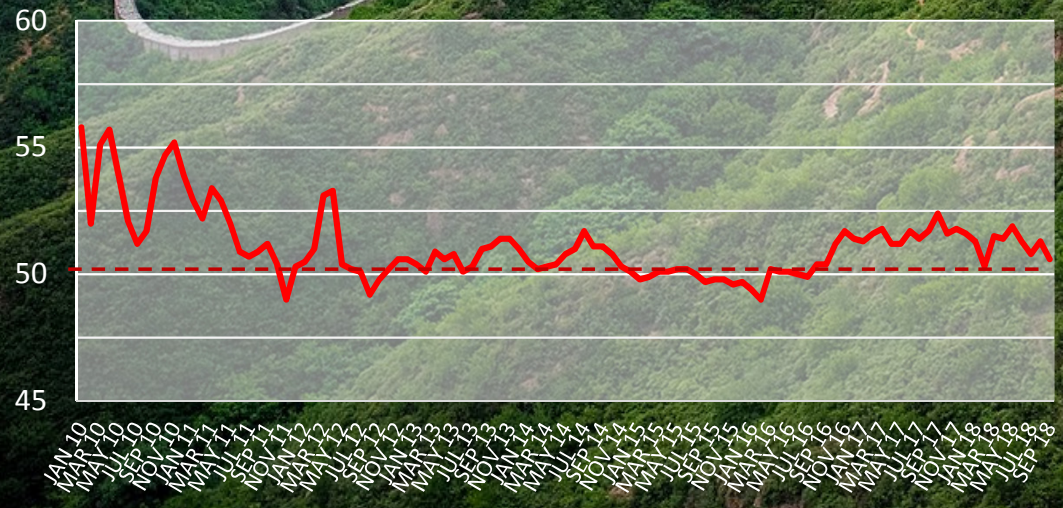
ROW is -(44) MM Lb

CHINA

GDP Growth

Source: IMF

Manufacturing Purchasing Index (PMI)

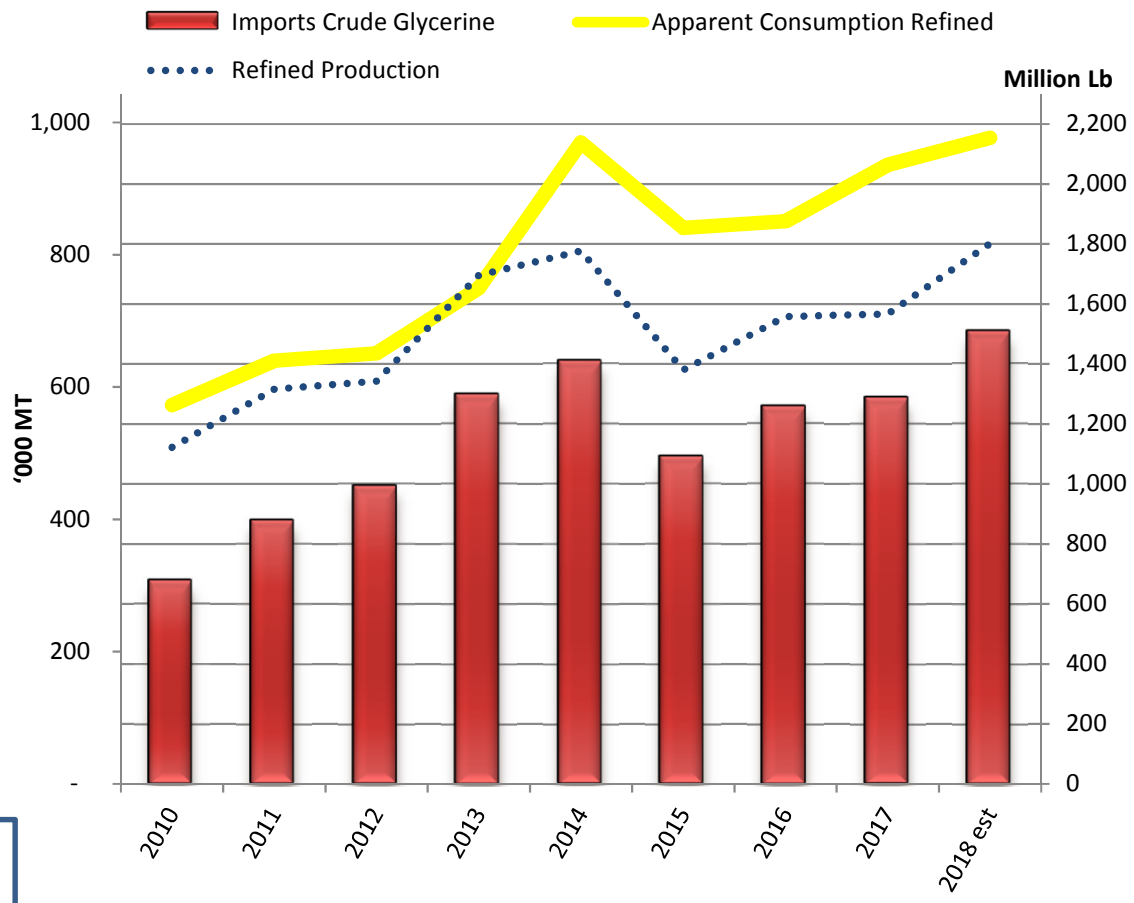


Source: CFLP

Glycerine Supply –Demand China

- China's population is 1.39 billion and estimated to be 1.42 billion by 2020.
- China realized exponential growth of glycerine consumption from 2005 – 2014.
- Lower propylene prices reduced glycerin consumption in the Epichlorohydrin market 2015-16.
- Govt. Environmental concerns shut EPI factories down due to chlorinated waste water in 2017.
  - This facilitated glycerine to epi (GTE)

Average annual GDP growth 2010 – 2014: 8.6%
Average annual GDP growth 2018-2022: 6.2%

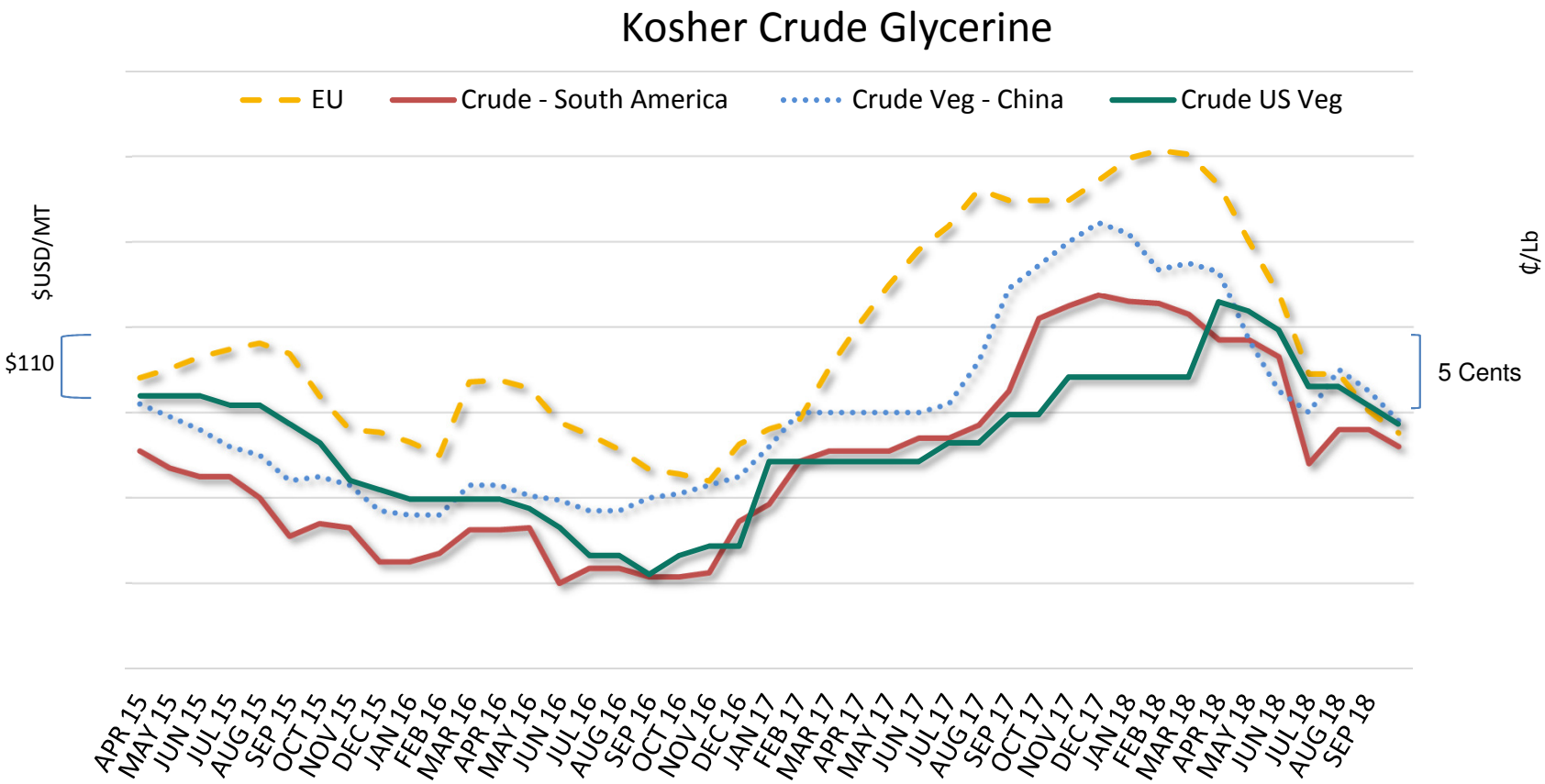


- Growth rate has stagnated in manufacturing sector
- Growth in consumption in consumer goods continues to rise with GDP.

Source: IMF; Worldbank; HBI; IHS; Market Knowledge

Evolution of Price Trends

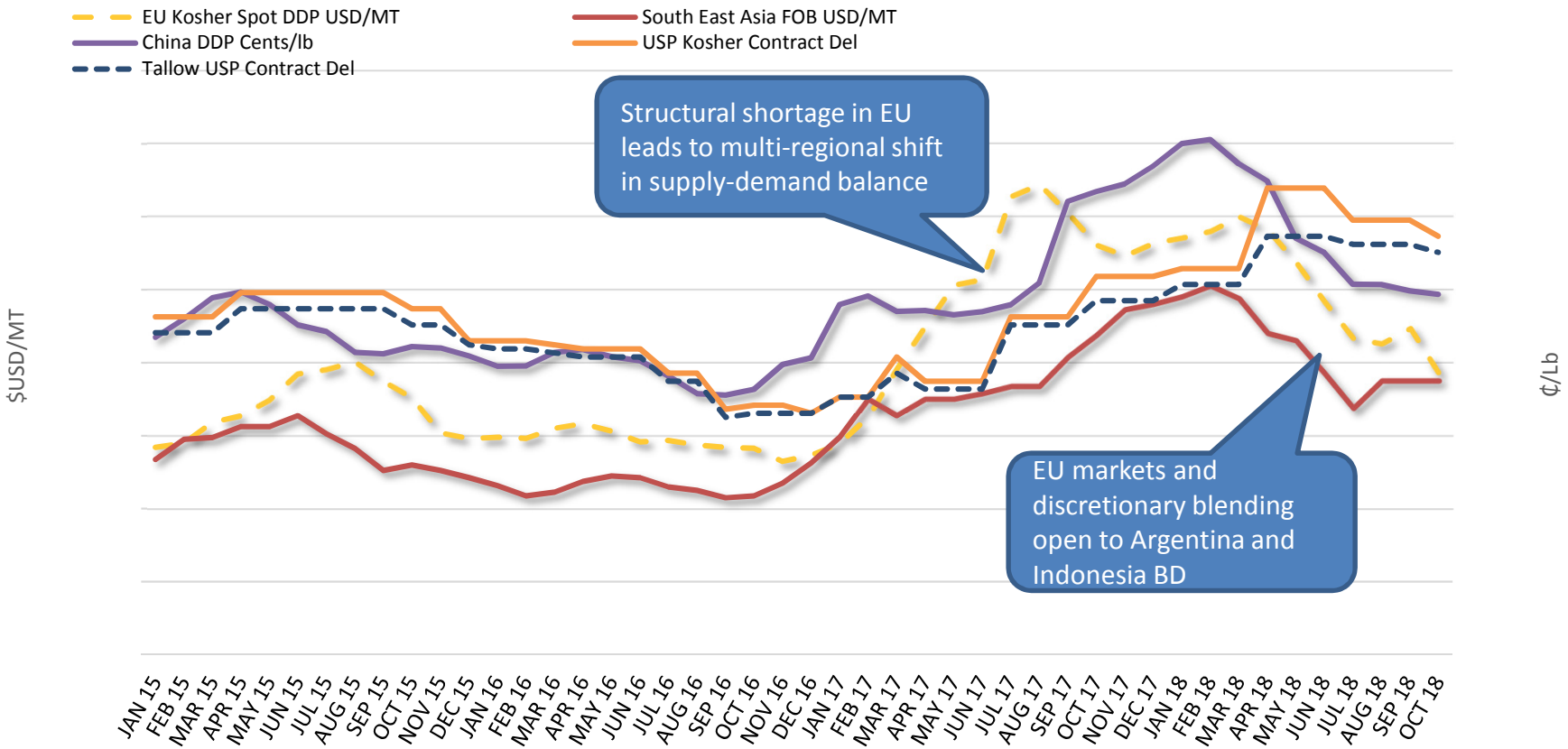
Regional Kosher Crude Glycerine Price Trend



Crude Glycerine prices appear to be near bottom in EU, China and South America.
US Crude glycerine prices are showing signs of softening.

Source: ICIS Pricing; Oleoliine

REGIONAL REFINED GLYCERINE PRICES (AVE)



Structural shortage of Kosher Glycerine in EU leads multi-regional shift in supply-demand balance. Global glycerine markets are balancing following discretionary blending of biodiesel.

Source: ICIS Pricing; Oleoline

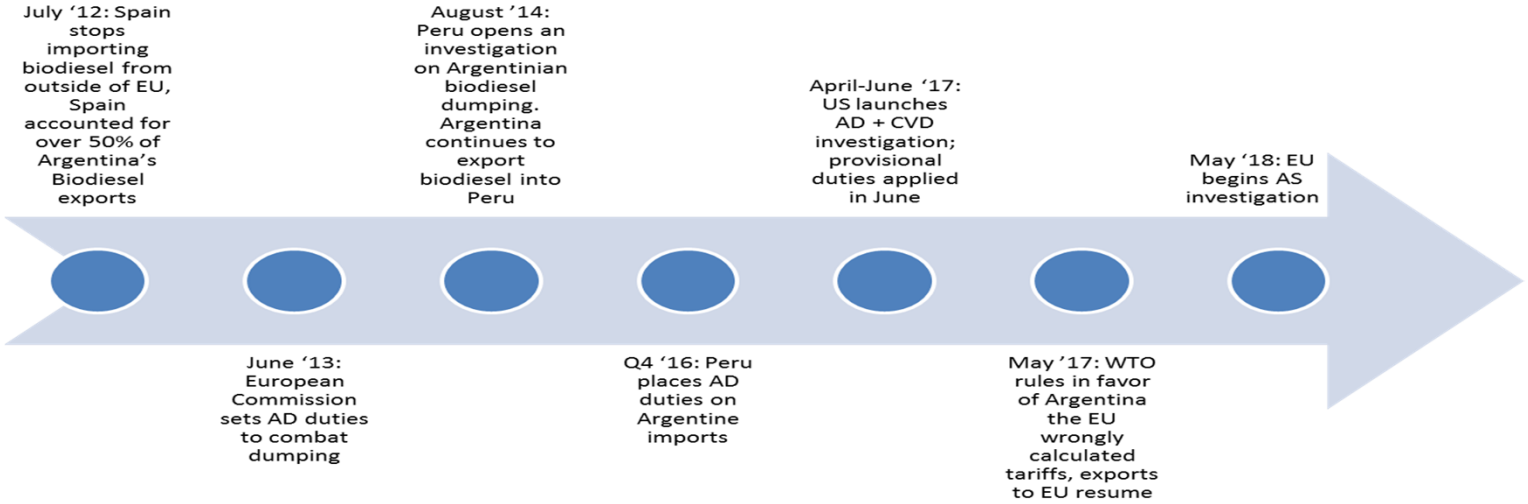
Government Intervention
Potential Impacts in the US

- US final AD and CVD duties ranging from 60-276%: Argentina and Indonesia. Companies named,
  - Indonesia: Wilmar, Musim Mas
  - Argentina: Renova, Cargill, Louis Dreyfus, Bunge, Molinos, Aceitera
- https://www.usitc.gov/publications/701_731/pub4690.pdf
- Argentina and Indonesia are effectively locked out of US market.
- Biodiesel Tax Credit has not been extended into 2018.
- RFS EPA proposed mandates were announced June 26th and will be finalized by Nov 30th.
  - BBD Current mandate - 2.1 billion gallons.
  - 2019 = 2.1 billion gallons; 2020 = 2.43 billion gallons.

•BBD: Biomass based diesel; includes biodiesel (methyl ester) and HVO/Renewable Diesel
•CVD: Countervailing Duties, Government facilitated dumping through subsidies or tax policy.
•AD: Anti-dumping, Selling below cost or under local equivalent ex works prices.
•NBB: US National Biodiesel Board

Government Intervention
Potential Impacts in Europe

- EU has reduced tariffs for Argentina and Indonesia from 2013 AD lawsuit due to WTO ruling.
  - Argentina shipped large volumes BD to EU Aug '17 through July '18.
  - EU filed a new lawsuit in January '18- Anti-Subsidy.
  - EU requires all Argentina BD to be registered effective May 24th.
    - Anti-subsidy is same as CVD; Argentina govt increased export tax to 8% Jan; 15% July 1.
    - Severe drought has impacted soybean supply; Argentina will have a difficult time competing with Indonesia, Malaysia and EU for market share in EU.
    - Provisional Tariff- EU opted to not issue October 31st.
    - Final decision on AS due February 2018.
    - <u>This is causing uncertainty in glycerine supply to Americas.</u>
  - Indonesia will likely produce palm based biodiesel for EU to reduce palm oil stocks.



•CVD: Countervailing Duties, Government facilitated dumping through subsidies or tax policy.
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Renewable Energy Directive (RED II)

- EU Renewable Energy Directive (RED)
  - Member States: pathway to reach 10% renewable energy by 2020.
- RED II to be finalized 2nd half 2018 and implemented Jan 1 2021.
- April 2017, EU Parliament voted to phase out use of palm oil in biofuels by 2020.
  - Called on EC (EU Commission) to define Sustainability criteria for palm oil and derivatives entering EU market.
- RED II: Food Oils Cap, 7% 2020 ➔ 3.8% 2030
  - Member states can set lower caps.
  - Focus on GHG and ILUC
- Petroleum environmental groups applaud draft RED II.
- EBB and Farmers criticize decision to focus on 2nd generation and move away from food oils.

What does the future look like?
Supply/Demand

- Global glycerine supply from biodiesel is volatile in 2018/19 with changing legislation in multiple regions.
  - Germany GHG Savings favors mixed feedstock.
  - EU moving to 2nd generation by 2020.
  - US mandates steadily increasing.
  - US tax credit distorting raw material market and causing intense fight for market share of biomass based diesel in years it is extended.
  - California LCFS (Low Carbon Fuel Standard)
  - Brazil mandate steadily increasing.

- Crude oil prices risk rising above >$80/barrel due geopolitical influences. Structurally, crude oil remains balanced. The net effect is volatility as it relates to discretionary blending economics.

- Vegetable oil stock levels are relatively high (especially palm oil) causing pressure on raw material prices; until it becomes economical to produce biodiesel. Once stock levels moderate, discretionary blending will pull back.

- New glycerine supply between 2019 – 2020 will come from oleochemical factories being built to support growth in Asian demand.

- Geographical shifts in supply will require EU to import glycerine and will limit exports. The Americas will become more important to global supply and world trade flows.

- Technology shift to renewable diesel/HVO/Co-processing will tighten the glycerine market over time.

- Substitution applications will remain sensitive to price swings as the markets restructure.

Market Sources

- Oleoline: Market Reports- Glycerine Weekly and Quarterly; Biodiesel
  - www.oleoline.com
  - Contact Jonathan Heming@33 139 346 613
- ICIS Pricing: Market Reports – Glycerine – US, Europe, Asia
  - www.icispricing.com
  - Contact Leela Landris@713-525-2607
- Chemical Economics Handbook/SRI Consulting/IHS
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