PREEM

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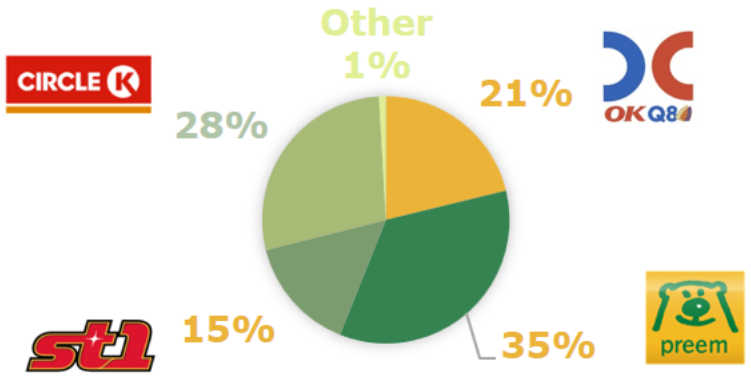
Largest Oil Refiner in the Nordics and One of the Largest Transportation Fuel Suppliers in NW Europe

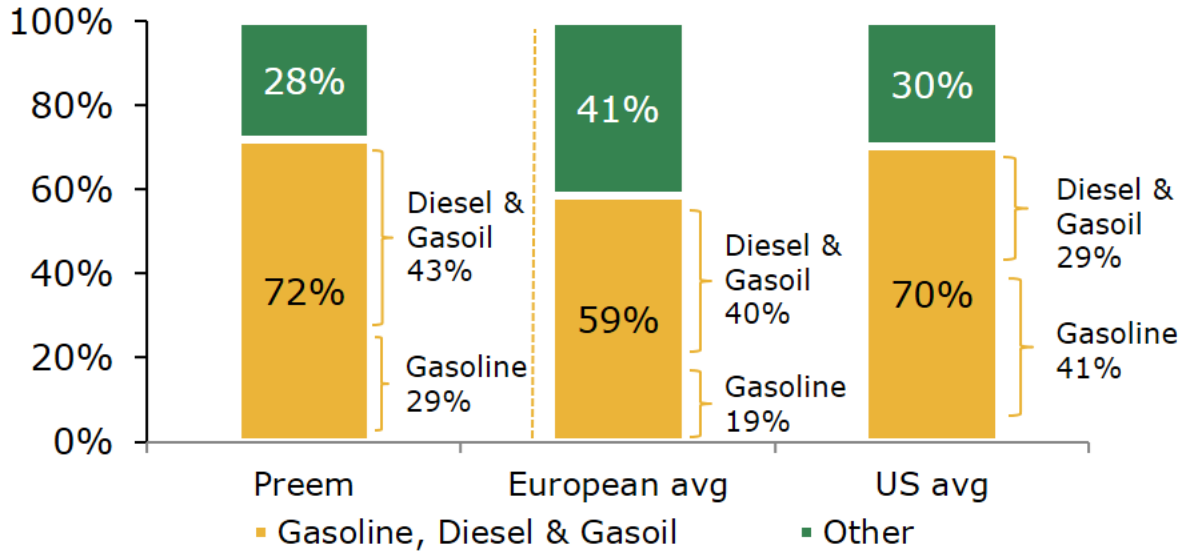
Largest Oil Refiner in the Nordic Region

- 345,000 bpd capacity equal to approx. 29% of the Nordic capacity and ca. 80% of Swedish capacity
- Strong marketing position in Sweden with approximately 40% share of all refined products sold
- A leader in the production and sale of transportation fuel in Sweden and one of the largest suppliers of transportation fuel in NW Europe
- Preem has today two of Europe's most energy and CO_2 efficient refineries (17% less CO_2), but want to do more to reduce refinery emissions even more to increase competitiveness going into the 2020:ies.

Swedish Diesel Market Share(1)

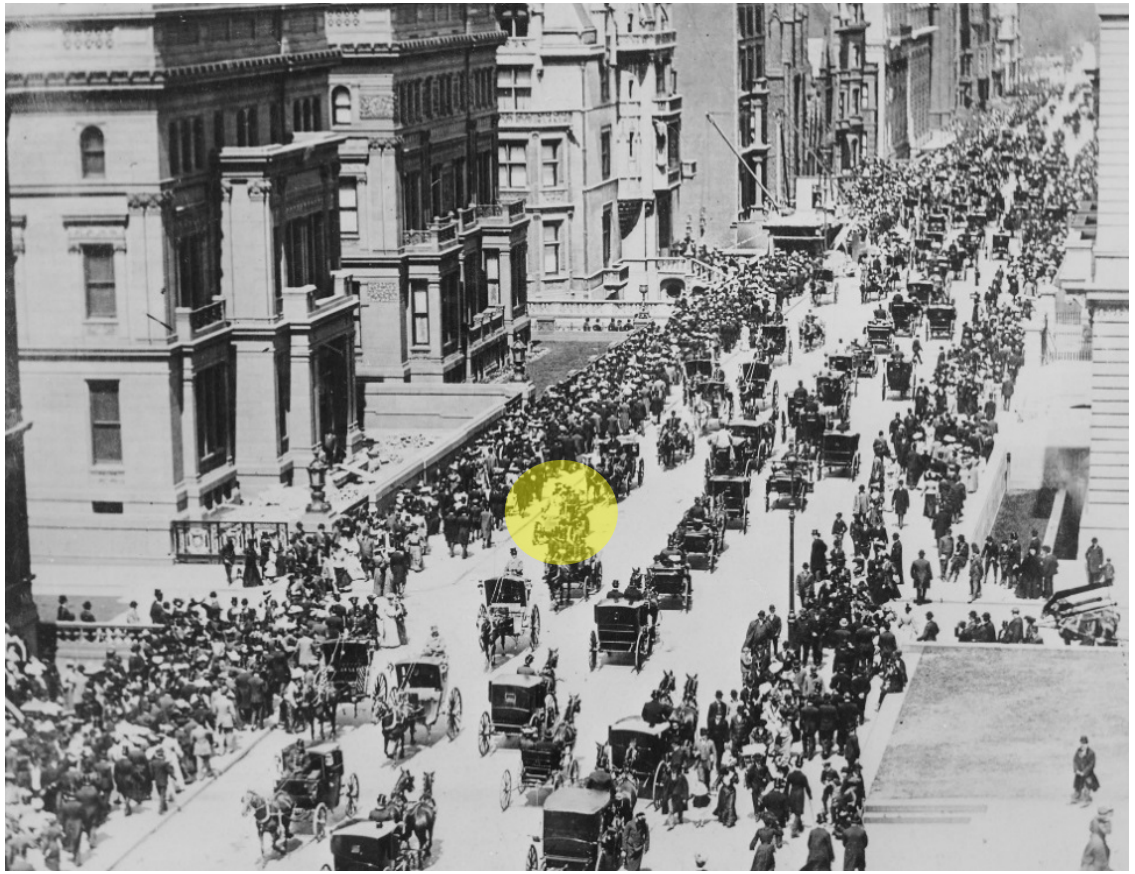


Preem is a Transportation Fuel Producer(2)



The World is changing rapidly

NYC 1900 – ser du bilen?



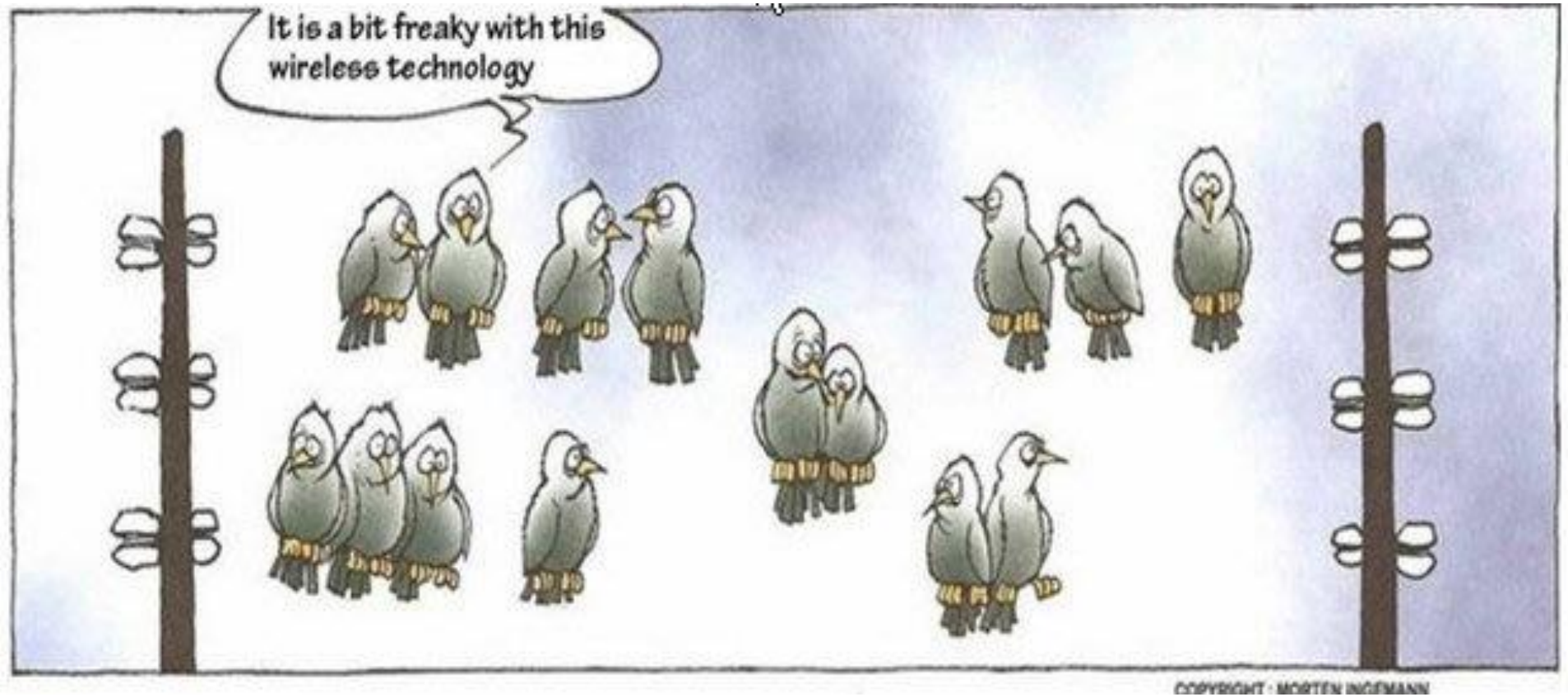
NYC 1913 – kan du se hästen?

Ready to take off with SAS

- Preem and SAS are exploring the possibility to use expansion in Gothenburg to produce Bio-Jet for the European market
- Incentives for producing Bio-Jet must be in parity with the incentives in the motor transportation market
- For Sweden this can be achieved by introducing similar system as the reduction quota in Sweden

RENEWABLE FUELS PRODUCTION

Impossible yesterday – possible today



FT and HEFA fuels are Synthetic Paraffinic Kerosene (SPK), consisting of linear or branched alkane, that can be blended at up to 50% in volume with petroleum-derived jet fuel to obtain a drop-in fuel. FT-SPK were approved as Annex A1 to ASTM D7566 in September 2009, and **HEFA-SPK as Annex A2 to ASTM D7566 in July 2011.** A number of companies across the world have developed or are developing such processes.

A1.2.2 *Co-processing:*
A1.2.2.1 Co-processing of mono-, di-, and triglycerides, free fatty acids, and fatty acid esters producing cohydroprocessed hydrocarbon synthetic kerosene is recognized as being acceptable for jet fuel manufacture.

Other feedstocks are excluded from jet fuel co-processing. The **co-processing** refinery units where process streams are used for jet production **shall not exceed 5 %** by volume of mono-, di-, and triglycerides, free fatty acids, and fatty acid esters in feedstock volume with the balance (>= 95 % by volume) being conventionally sourced hydrocarbons as described in 6.1.

(1) Co-processing of mono-, di-, and triglycerides, free fatty acids, and fatty acid esters shall include hydrocracking or hydrotreating and fractionation. Processing may also include other conventional refinery processes. The final product is limited to 5 % by volume of co-hydroprocessed synthesized kerosene in any jet batch. Refer to X1.15.5 for a discussion of biobased carbon content and identification of the applicable test method.

TABLE 1 Detailed Requirements of Aviation Turbine Fuels[A]

Property		Jet A or Jet A-1	Test Methods[B]
COMPOSITION			
Acidity, total mg KOH/g	max	0.10	D3242/IP 354
1. Aromatics, percent by volume	max	25	D1319 or IP 156
2. Aromatics, percent by volume	max	26.5	D6379/IP 436
Sulfur, mercaptan,[C] percent by mass	max	0.003	D3227/IP 342
Sulfur, total percent by mass	max	0.30	D1266, D2622, D4294, D5453, or IP 336
VOLATILITY			
Distillation temperature, °C:			D86,[D] D2887/IP 406,[E] D7344,[E,G] D7345,[E] IP 123[D]
10 % recovered, temperature	max	205	
50 % recovered, temperature		report	
90 % recovered, temperature		report	
Final boiling point, temperature	max	300	
Distillation residue, %	max	1.5	
Distillation loss, %	max	1.5	
Flash point, °C	min	38[H]	D56, D93,[I] D3828,[I] IP 170[I] or IP 523[I]
Density at 15 °C, kg/m^3		775 to 840	D1298/IP 160 or D4052 or IP 365
FLUIDITY			
Freezing point, °C	max	−40 Jet A[J]	D5972/IP 435, D7153/IP 529, D7154/IP 528, or D2386/IP 16
		−47 Jet A-1[J]	
Viscosity −20 °C, mm^2/s[K]	max	8.0	D445/IP 71, Section 1,D7042,[L] or D7945
COMBUSTION			
Net heat of combustion, MJ/kg	min	42.8[M]	D4529, D3338, D4809, or IP 12
One of the following requirements shall be met:			
(1) Smoke point, mm, or	min	25.0	D1322/IP 598
(2) Smoke point, mm, and	min	18.0	D1322/IP 598
Naphthalenes, vol, %	max	3.0	D1840
CORROSION			
Copper strip, 2 h at 100 °C	max	No. 1	D130/IP 154
THERMAL STABILITY			
(2.5 h at control temperature of 260 °C min)			
Filter pressure drop, mm Hg	max	25	D3241[N] /IP 323[N]
Tube rating: One of the following requirements shall be met:[O]			
(1) Annex A1 VTR, VTR Color Code	Less than	3 (no peacock or abnormal color deposits)	
(2) Annex A2 ITR or Annex A3 ETR, nm average over area of 2.5 mm^2	max	85	
CONTAMINANTS			
Existent gum, mg/100 mL	max	7	D381, IP 540
Microseparometer,[P] Rating			D3948
Without electrical conductivity additive	min	85	
With electrical conductivity additive	min	70	
ADDITIVES		See 6.2 [Q]	
Electrical conductivity, pS/m			D2624/IP 274

[A] For compliance of test results against the requirements of Table 1, see 7.2.
[B] The test methods indicated in this table are referred to in Section 11.
[C] The mercaptan sulfur determination may be waived if the fuel is considered sweet by the doctor test described in Test Method D4952.
[D] D86 and IP 123 distillation of jet fuel is run at Group 4 conditions, except Group 3 condenser temperature is used.

TABLE A2.1 Detailed Batch Requirements; SPK from Hydroprocessed Esters and Fatty Acids[A]

Property		HEFA–SPK	Test Method[B]
COMPOSITION			
Acidity, total mg KOH/g	Max	0.015	D3242/IP 354
VOLATILITY			
Distillation—both of the following requirements shall be met:			
1. Physical Distillation			D86[C] or IP 123[C] or D7345
Distillation temperature, °C:			
10 % recovered, temperature (T10)	Max	205	
50 % recovered, temperature (T50)		report	
90 % recovered, temperature (T90)		report	
Final boiling point, temperature	Max	300	
T90-T10, °C	Min	22	
Distillation residue, percent	Max	1.5	
Distillation loss, percent	Max	1.5	
2. Simulated Distillation			D2887
Distillation temperature, °C:			
10 % recovered, temperature (T10)		report	
50 % recovered, temperature (T50)		report	
90 % recovered, temperature (T90)		report	
Final boiling point, temperature		report	
Flash point, °C	Min	38[D]	D56, D3828[E] , IP 170[E] or IP 523[E]
Density at 15 °C, kg/m^3		730 to 772[E]	D1298/IP 160, D4052 or IP 365
Freezing point, °C	Max	−40	D5972/IP 435, D7153/IP 529, D7154/IP 528, or D2386/IP 16
Existent gum, mg/100 mL	Max	7	D381, IP 540
FAME, ppm	Max	<5	IP 585 or IP 590
Thermal Stability (2.5 h at control temperature)			
Temperature, °C	Min	325[G]	D3241[H] /IP 323[H]
Filter pressure drop, mm Hg	Max	25	
Tube rating: One of the following requirements shall be met:[I]			
(1) Annex A1 VTR, VTR Color Code	Less than	3	
		No peacock or abnormal color deposits	
(2) Annex A2 ITR or Annex A3 ETR, nm avg over area of 2.5 mm^2	Max	85	
ADDITIVES			
Antioxidants, mg/L[J]	Min	17	
	Max	24	

Not at all the same spec for renewable Jet as for fossil Jet A1

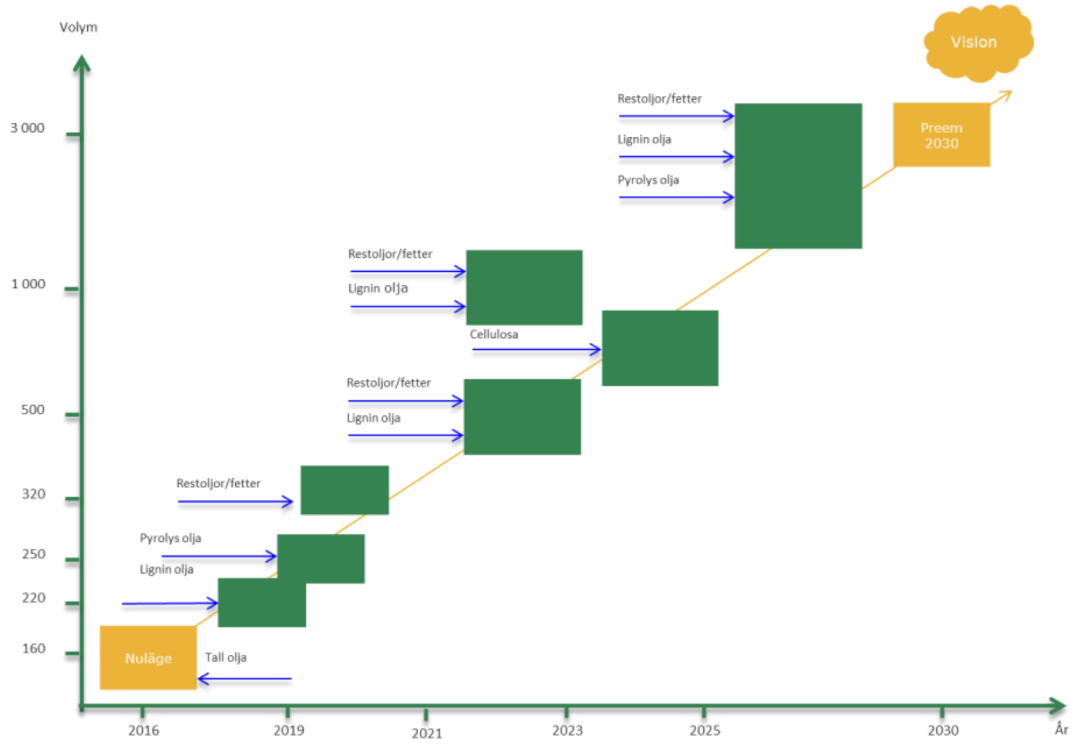
TABLE A2.2 Other Detailed Requirements; SPK from Hydroprocessed Esters and Fatty Acids[A]

Property		HEFA–SPK	Test Method[B]
Hydrocarbon Composition			
Cycloparaffins, mass percent	Max	15[C]	D2425
Aromatics, mass percent	Max	0.5	D2425
Paraffins, mass percent		report	D2425
Carbon and Hydrogen, mass percent	Min	99.5	D5291
Non-hydrocarbon Composition			
Nitrogen, mg/kg	Max	2	D4629/IP 379
Water, mg/kg	Max	75	D6304 or IP 438
Sulfur, mg/kg	Max	15	D5453 or D2622
Metals (Al, Ca, Co, Cr, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, P, Pb, Pd, Pt, Sn, Sr, Tl, V, Zn), mg/kg	Max	0.1 per metal	D7111 or UOP 389
Halogens, mg/kg	Max	1	D7359

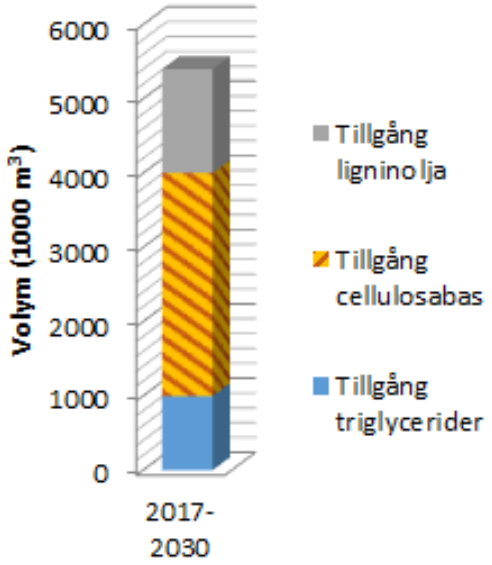
[A] For compliance of test results against the requirements of Table A2.2, see 7.4.
[B] The test methods indicated in this table are referred to in A2.6.2.
[C] Maximum cycloparaffin composition is based on current experience with the approved synthetic fuels and is within the range of what is typical for refined jet fuel.

PREEMS POTENTIAL:

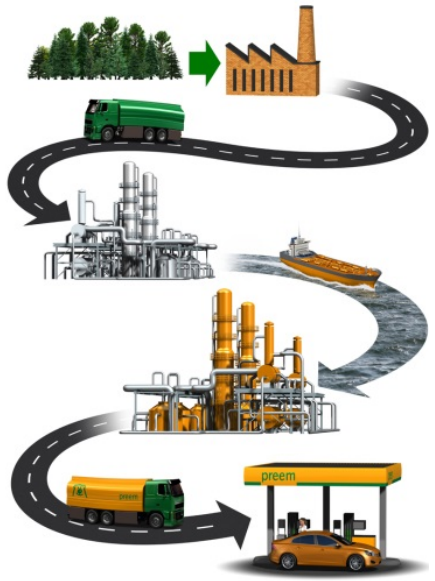
minst 40 % av transportenergibehovet 2030 om politik, teknik och råvaror säkras



Preems behov av råvara



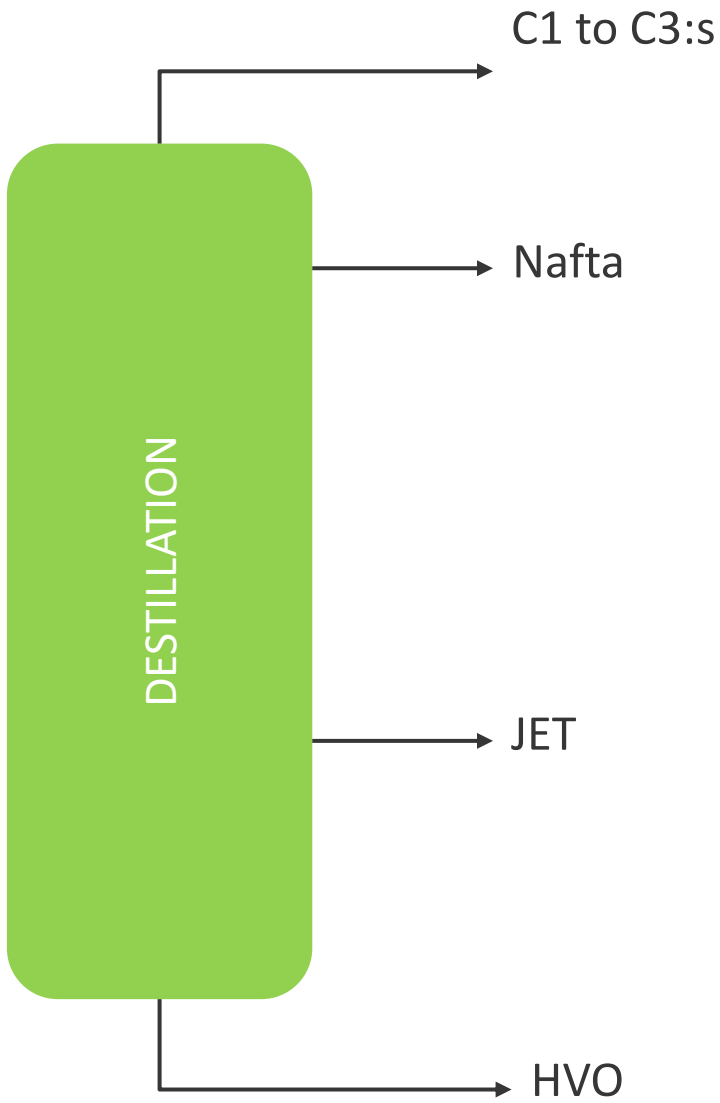
Uppskattad tillgång av hållbar råvara



Uppbyggnad av ny värdekedja

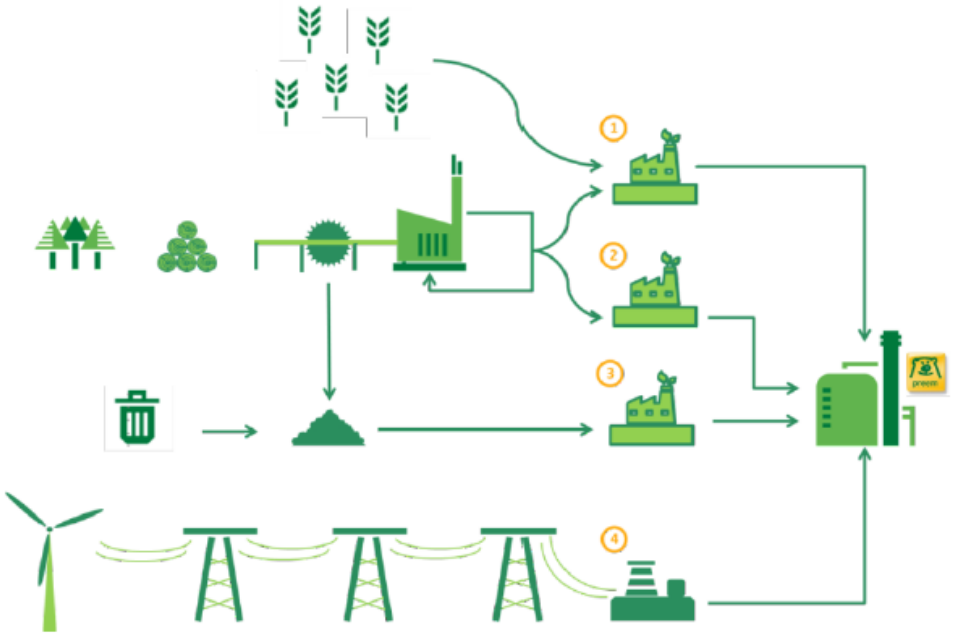
- Råvaror från skogen är kritiskt för att uppnå målen.
- Partnerskap viktigt för att starta uppbyggnad och utveckling av den nya värdekedjan.
- Uppgraderingsanläggningar för råvara kommer byggas upp efterhand som efterfrågan ökar.

Yields: nafta, JET och HVO



	Yields
Summerquality HVO (wt%)	10 wt% nafta 35 wt% JET 40 wt% HVO
Winterquality HVO (wt%)	10wt% nafta 20 wt% JET 60 wt% HVO

New business constellations, collaborations and value chains



1. Bio-oil valorization
2. Lignin extraction and valorization
3. Forrest and saw mill bi-products and residue liquefaction and valorization
4. Electrolysis of water to H_2

RENFUEL
LIGNIN BIO OILS
Fortum
SÖDRA
VATTENFALL
CHALMERS
Valmet
SVEASKOG
Rottneros
BIOZIN AS
– Circular energy solutions –
SAS
Lantmännen
preem


preem