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Aviation Fuel from Worlds Forest Workshop Trondheim



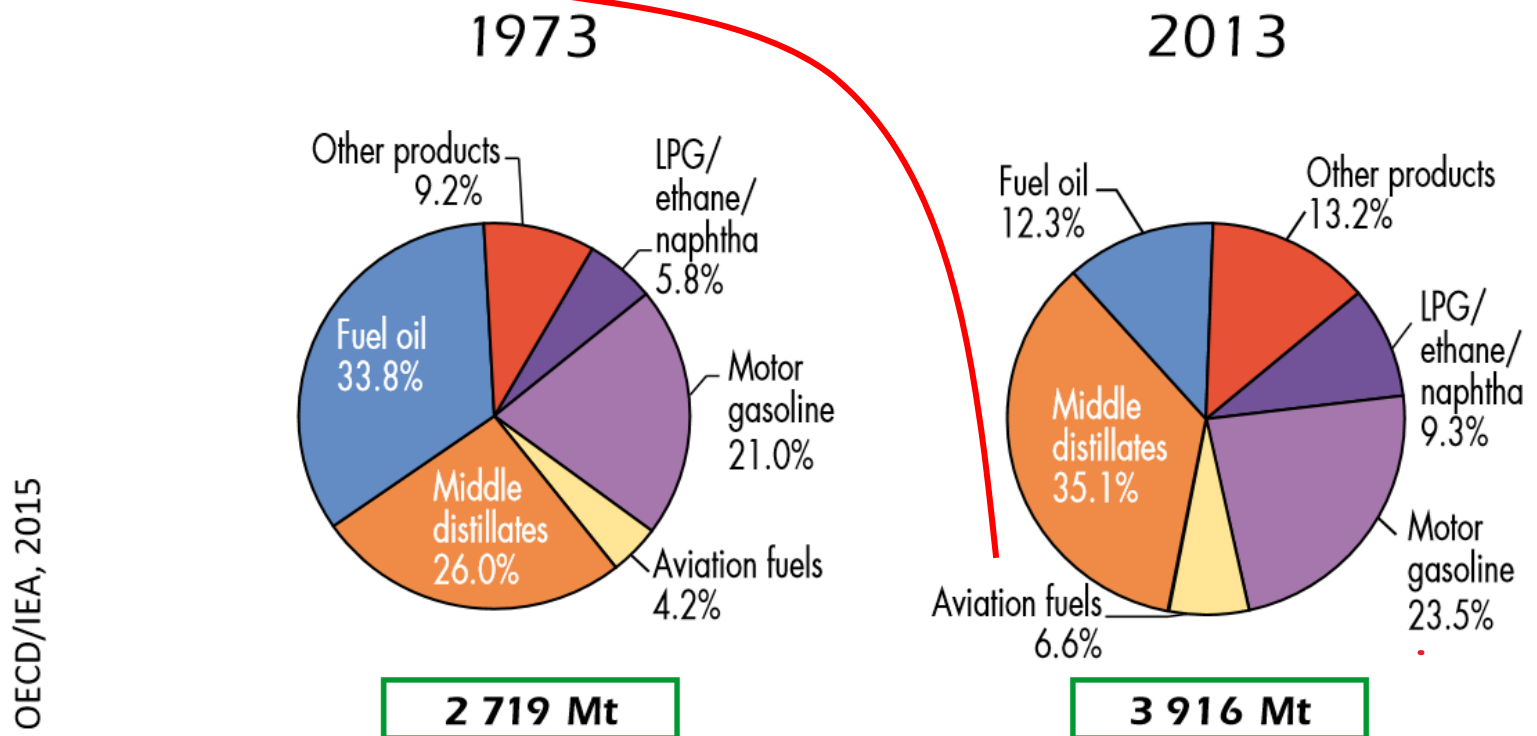
Martin Rügsegger, *ETECA GmbH*, CH-3617 Fahrni

IEA Bioenergy, Task 33, Mai 2016, Trondheim Norway



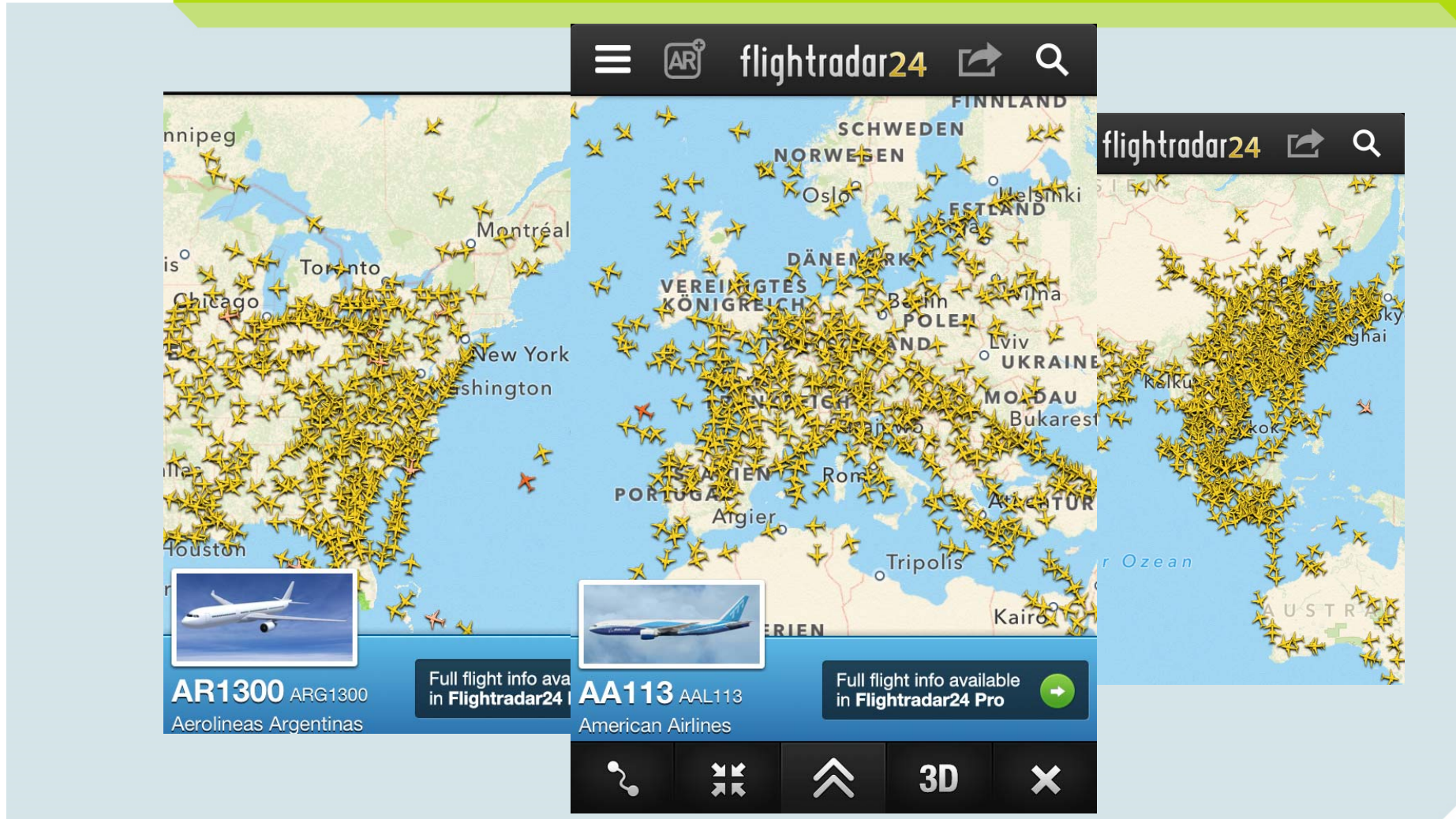
World Aviation Fuel Production 258.458 Mt =
258 458 000t Av'fuel = 2 500 000 GWh / 8000 h => 312 GW

1973 and 2013 shares of refinery output by product





It looks like that: every houer, every day, all year pictures are from a a real time radar





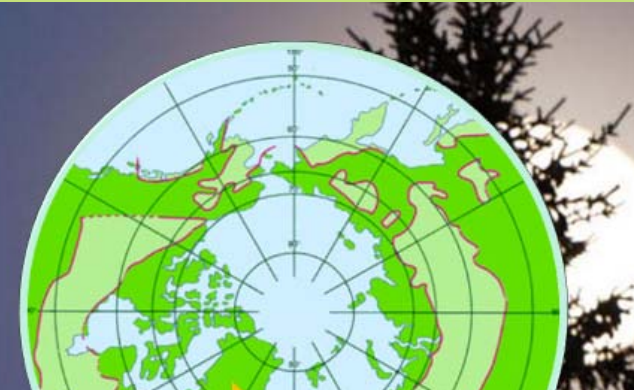
Lots of biomass for energy will be needed...



- < 1 million m^3 (~ 2 TWh energy)
- Yearly forest growth (roundwood) in Sweden = 100 million m^3
- Swedish energy demand = 400 TWh



FAO 2012 4 000 000 000 ha = 40 000 000 km²
Forest and woodland

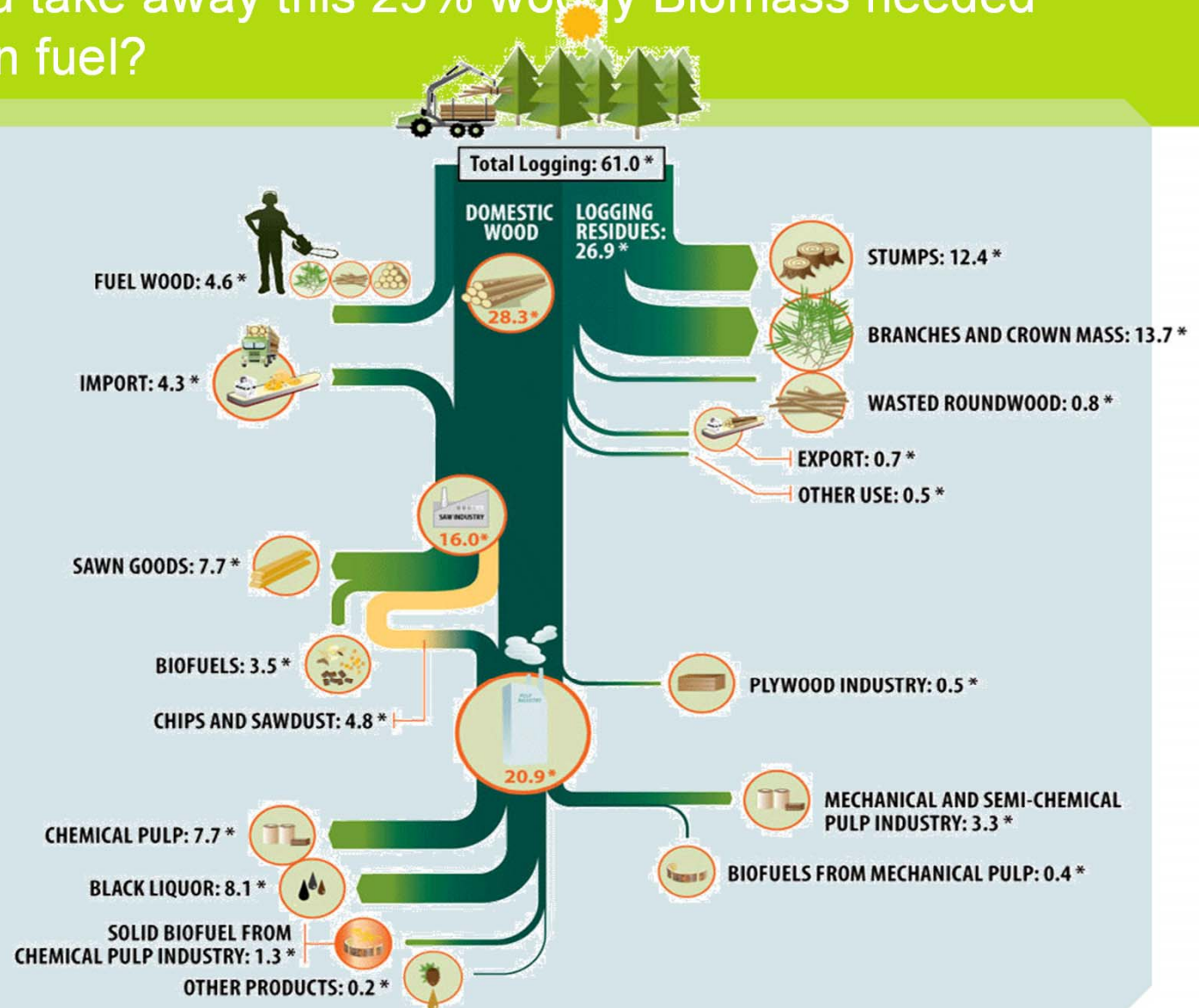


- 600 million hectares
- 18 % of the world's forest land
- 20 % of the world's industrial timber

Boreal forest	600 000 000 ha =	6 000 000 km ²	18%
World	3 333 333 333 ha =	33 333 333 km ²	100%



Whom you take away this 25% woody Biomass needed for aviation fuel?



*Million tons dry biomass

Source:
Biomasseflöden i svensk
skogsnäring 2004,
Per Olov Nilsson.
Rapport 23-2008
Skogsstyrelsen
ISSN 1100-0295



What is the strategy? What will be reality for REN Kerosene? How much you will replace 0.1%.....1%..... more?

- BP Rotterdam refinery since 1967
19.000.000 tpy 57 600 tpd → 26 GW Power output
- Jamnagar India worlds biggest refinery since 2010
66 000 000 tpy 200 000 tpd (330 days) 8 250 t/h
→ 100 GW Power output
- For world fossil jet fuel production 3x Jamnagar needed

- Bio jet fuel production power for: (8000h/y @ 300GW)

100% 300 GW => 16 000 000 km² forest (4000km)

1% 3 GW => 160 000 km² forest (400km)

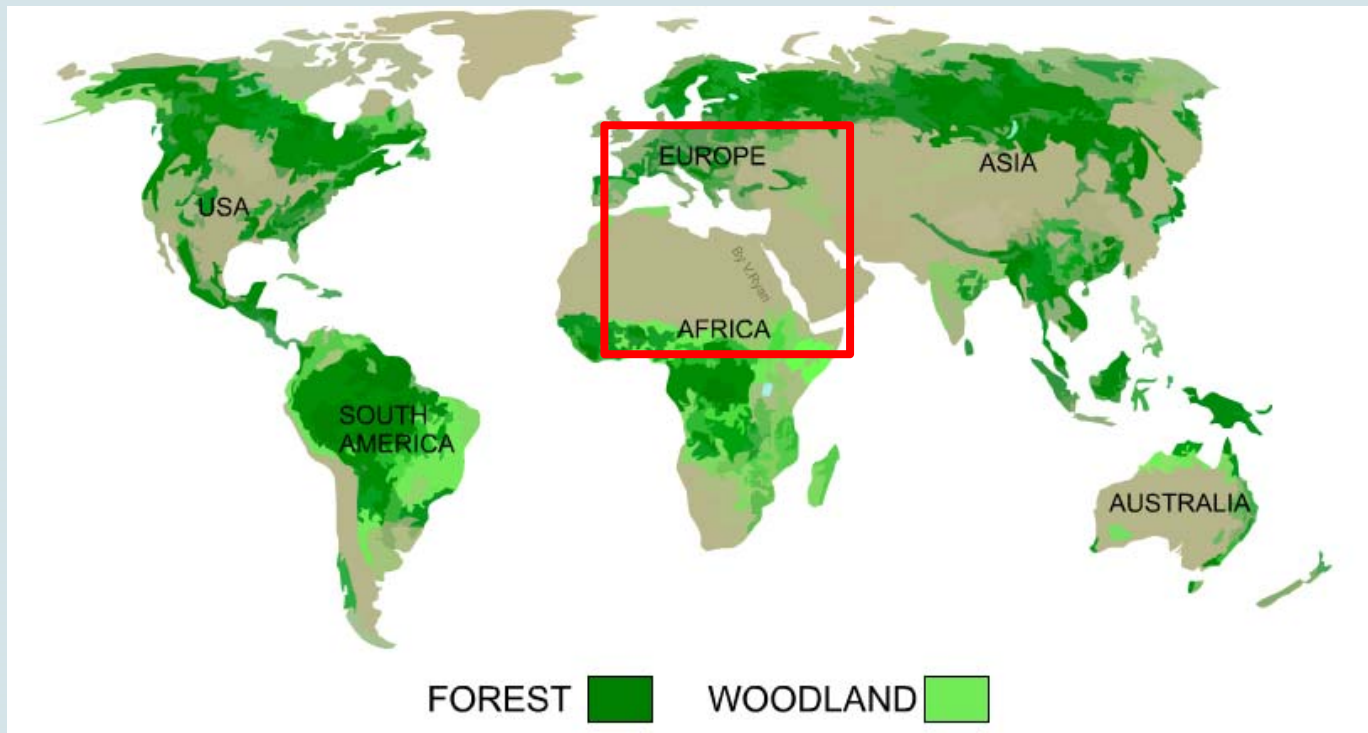
0.1% 300 MW => 16 000 km² forest (126km)

means a forest square with a length of 126 x 126 km!



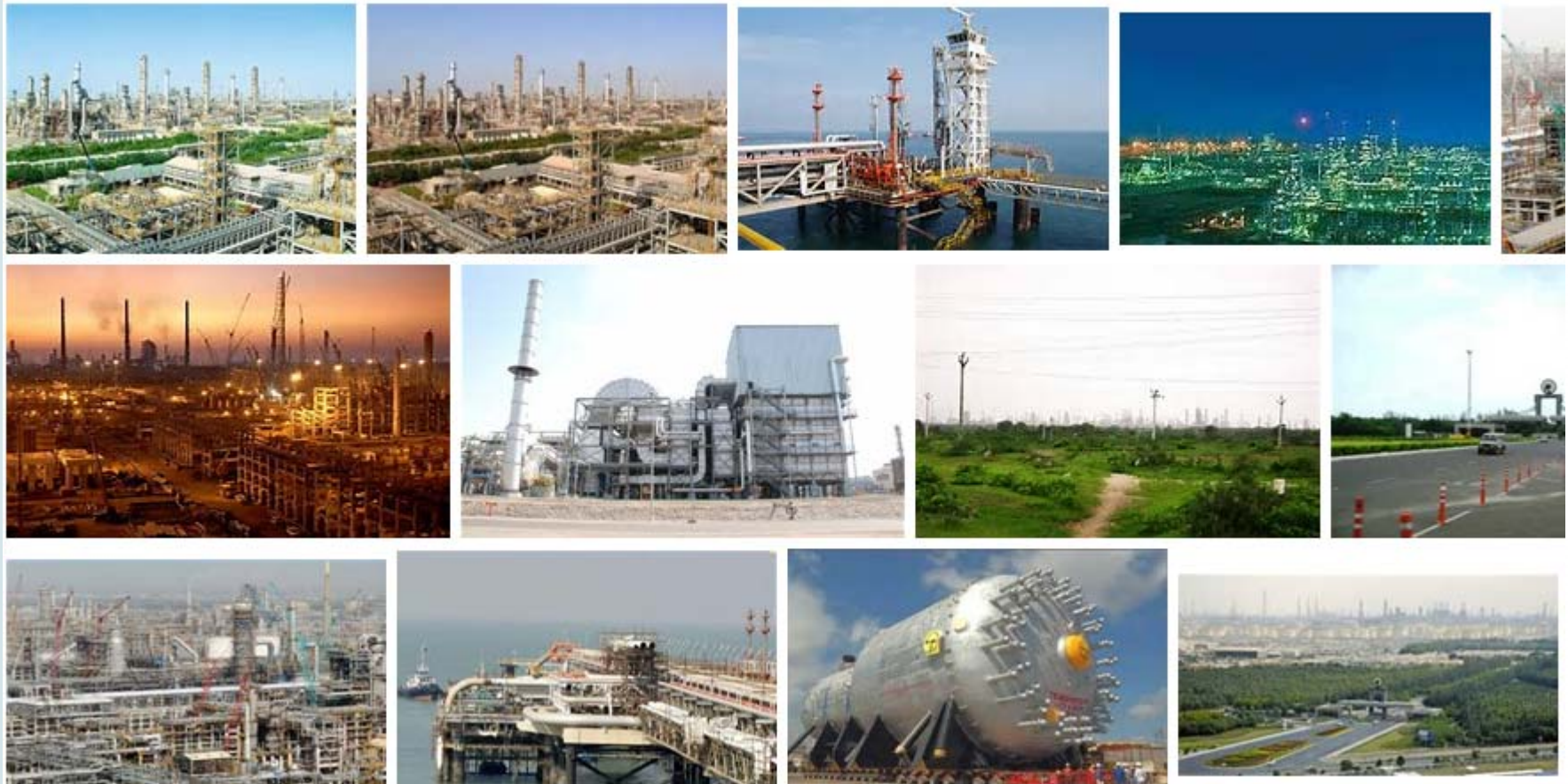
So much surface is needed, with average forest output, sustainable harvesting when 25% goes into Kerosene

- yearly sustainable harvestable 2.5m³/ha waste wood from 10m³/ha Wood total
- For 100% Aviation Fuel = 16 000 000 km² ca 50% of Worlds forest





Jamnagar is for me inconceivable huge 300 GW 3x Jamnagar are needed

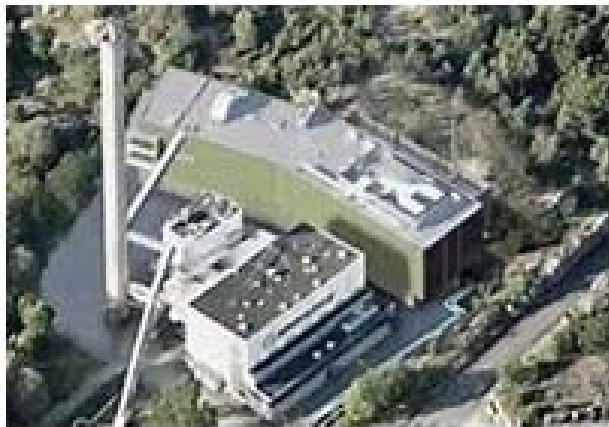




20 MW GobiGas Gasifier and Methanation biggest European REN fuel production plant



Göteborg En
 **GoBiGas**





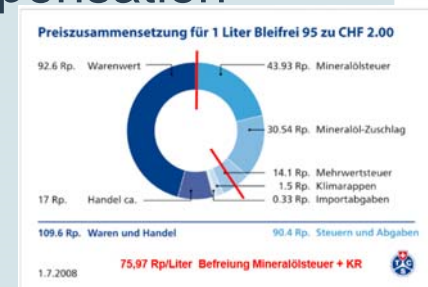
Why go into aviation fuel market with REN Kerosene?

- Aviation fuel it is one of the hardest market existing
- Highest security and quality standards needed
- Kerosene is worldwide a tax-free fuel
- No CO2 tax nor CO2 compensation or mitigation strategy world wide exists for aviation fuel
- For any kind production plants today counts as bigger than better (small are closed down due economics)
- REN fuel production today in operation 20 MW



Conclusion

- REN Aviation fuel is green Airline Marketing with very little impact
- Even negative rebound effect for more fossil flights will appear
- Why not go with REN fuel to surface road traffic first
 - Profit from CO2 taxes for mitigating and compensation
 - get a better price
 - Get faster increase of REN fuel production
 - Even so it will be hard enough
- Extend and grow new forest today on waste land to get the biomass for tomorrows REN aviation fuel





Make it fly..... try hard
Thanks for your attention, any questions?

