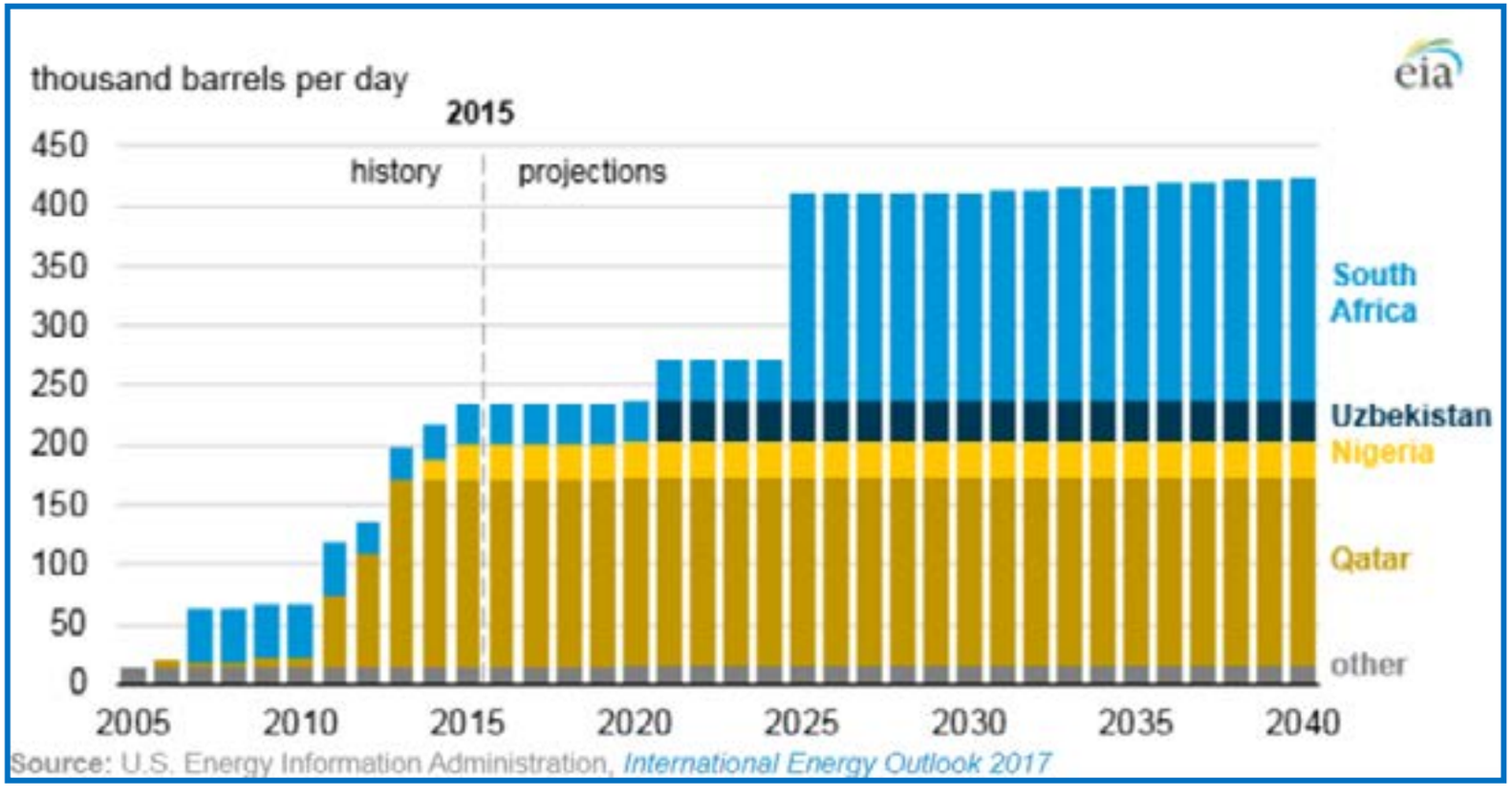
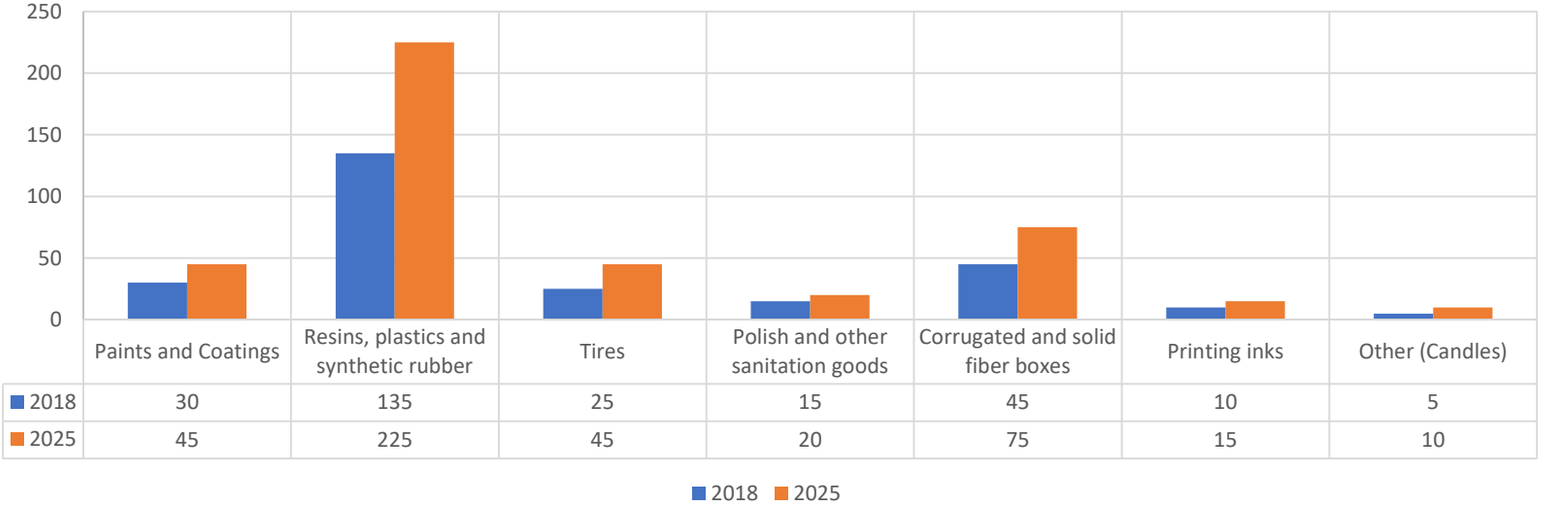
SASOL, presented by *John Smith*

GTL Plant Production 2005-2040



North America - FT Wax (USD Million)



FT Wax in NA is expected to grow at CAGR 7.3% from 2018 to 2025

Fischer Tropsch Wax Producers

- Shell Ltd,
- Nippon Seiro Co. Ltd
- Nanyang Saier
- Sasol Limited
- DEUREX AG
- Evonik Industries
- Yimeiwax

Sasol FT Waxes

Wax Type	Brand
Paraffin	Sasolwax
Dispersions	Hydrowax
Fischer Tropsch Spray	Sasolwax Spray
Fisher Tropsch Ground	Sasolwax G
Fischer Tropsch Narrow Cut	Sasolwax NCM
Waxes for corrosion protection	Sasolwax
Dispersions for corrosion protection	Sasolwax Protect

PE and Fischer Tropsch Waxes

Fischer Tropsch

Straight Chain and saturated high carbon alkanes with MW 500-1000

Fine crystal structre, high melting point, narrow melting point range, low oil content, low penetration, low mobility, low melting viscosity, hard, water resistance and high stability

Molecular Weight	Molecular Structure
Lower MW wax	***Linear wax***
Good slip performance	More crystalline
Poor solvent resistance	High Density
	Hard and less soluble
Higher MW wax	***Branched wax***
Good rub performance	Less crystalline
Good solvent resistance	Low density
	Soft and more soluble

FT Wax vs PE Wax

1. MW: FT MW is lower than PE wax, they have higher crystallinity (lower branching). Ft can penetrate high-viscosity macro-molecular chains, which can significantly reduce the melt viscosity. They have small migration in the initial process and a lubrication effect in the later stage
2. Structure: FT wax is a saturated direct paraffin with no double bond, strong antioxidant ability and good weather resistance
3. Viscosity: FT wax has lower viscosity than PE wax

Sasol Hard FT Waxes

- Consistent high quality
- Low viscosity
- High degree of linearity
- Wide high melting range
- Wide range of hardness
- High degree of crystallinity
- Excellent thermal stability
- Very low surface energy
- USA Food and Drug Administration (FDA) and German Federal Institute for Risk Assessment (BfR) for food contact materials
- Certified ISO 9001, ISO 14001 and OHSAS 18001 supplier
- Attractive alternatives to polyethylene waxes

Distribution, Patents and Projects

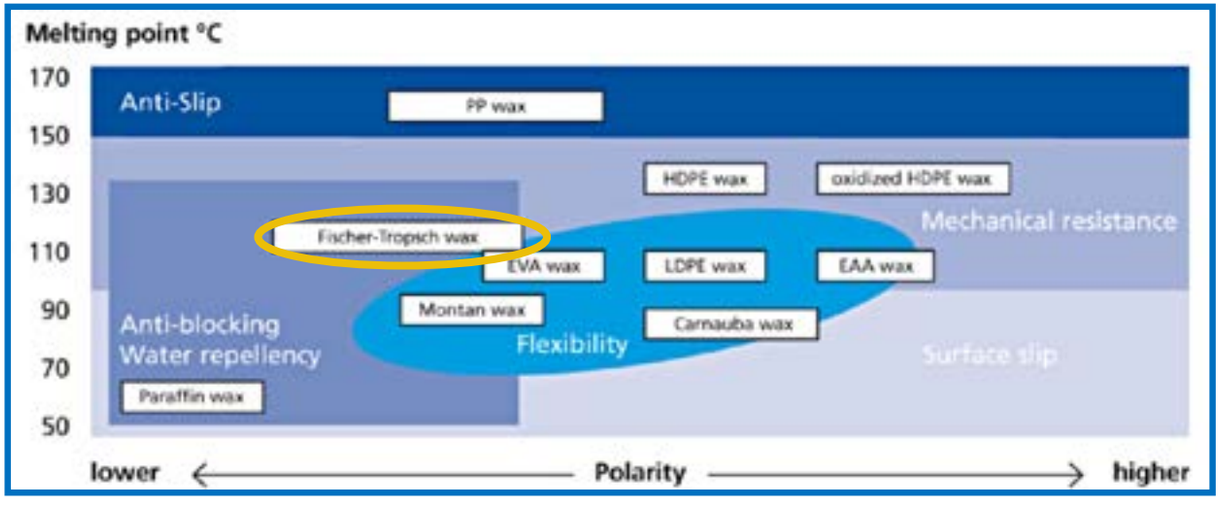
- ***Lintech – Distribution***
  - Industrial Waxes for the Inks, Paints, Coatings and select Adhesive markets
  - The agreement became effective June 1, 2018
  - The product portfolio includes Fischer-Tropsch, Paraffin and Microcrystalline waxes along with Petroleum Jellies
  - 13 regional warehouses
- ***Sasol Patents***
  - Several patents on producing parafinic and FT waxes, modifiying functionality and blending waxes
- ***Lake Charles Chemicals Project (LCCP)***
  - It will triple the Sasol's chemical production capacity in the U.S.
  - Produce 1.5 million tons of ethylene annually
  - Ethane Cracker reached beneficial operation on 27 August 2019
  - Six downstream plants on site to produce a range of high-value derivatives

Syngas

- Syngas can be produced from natural gas, coal, biomass, or virtually any hydrocarbon feedstock, by reaction with steam (steam reforming), carbon dioxide (dry reforming) or oxygen (partial oxidation).
- Syngas is used as an intermediate in producing synthetic petroleum for use as a fuel or lubricant via the Fischer–Tropsch process
- Sasol produces Syngas with steam and oxygen, sub-bituminous coal supplied by Sasol Mining (natural gas is used as a supplemental feedstock)
- Sasol produces fuel and chemicals with a proprietary iron-based Fischer Tropsch process

Waxes Types and Characteristics

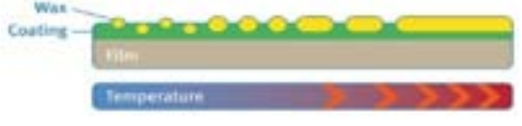
Natural Waxes				Semi-synthetic		Synthetic	
Living		*Fossil*				*Homopolymers*	*Copolymers*
Animal	**Vegetable**	**Carbon**	**Oil**				
Bees	Carnauba	Montan	Paraffin	Amide	Modified Montan	Polyethylene	Ethylene vinyl acetate
						Polypropylene	Ethylene acrylic acid
						Fischer-Tropsch	



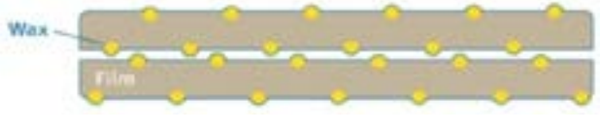
Wax Mechanisms

- Wax must migrate to the surface and be present in enough quantity for desired properties

- ***The Blooming Mechanism***
  - Molten wax particles float (or bloom) to the surface. The coating cools down and re-crystallization of wax particles takes place, forming out a thin but continuous wax-enriched surface layer. Usually, the softer (low-melting) the wax, the more predominant the blooming mechanism. Incompatibility between wax and coatings can enhance the migration phenomenon



- ***The Ball Bearing Mechanism***
  - Solid wax particles migrate individually to the surface. They act as a physical spacer by protruding above the coating surface, preventing another surface from coming into close contact. Hard and high-melting-point waxes (high density polyethylene - HDPE, PTFE) work through this mechanism. Particle density and the extent of protrusion influence the effect on surface properties



Wax Processing

- Wax is introduced into the coating/ink in the form of discrete microfine particles:
- ***Compounding***

  It involves dissolving the wax in a solvent and then rapidly cooling the solution with cold solvent (“shock cooling”)
- ***Emulsifying***

  Preparing a very fine particle size dispersion of a solid wax in water with the addition of emulsifiers
- ***Dispersing***

  Mixing solid waxes into a vehicle (oil, solvent or water) using different media mills
- ***Micronizing***

  Grinding

  Reduce particle size by jet milling which consists of blowing solid wax into a chamber at very high speed

  Spraying

  Spray to a very fine particle size by using pressure and a die configuration with further classification to a narrow particle size distribution

  Incorporation

  The ground or sprayed micronised product is incorporated into the coating by means of pre-compounding or direct incorporation. Pre-compounding involves putting the wax into the vehicle under high-speed agitation or putting it into the higher viscosity portion of the mix and dispersing it thoroughly

Top NA Paints/Coatings and Ink Companies

Paints and Coatings	Coatings $	Inks	Inks $
PPG	14.8 B	Sun Chemical	1.5 B
Sherwin Williams	11.8 B	Flint Group	1.0 B
RPM International	5.0 B	INX	375 M
Axalta Coatings Company	4.4 B	CR/T	250 M
Behr	1.9 B	Siegwerk	215 M
Benjamin Moore	1.3 B	Dupont Ink Jet	175 M
Ennis-Flint	625 M	Wikoff Color	170 M
Shawcor	405 M	Hostmann-Steiberg	150 M
Kelly Moore	300 M	Sanchez SA de CV	131 M
ICP	250 M	Toyo Inc America	105 M

Effect of Wax on Coatings

- ***Abrasion, rub and mar resistance***
  - Waxes are used to protect a coating and/or its substrate from cosmetic and physical damage. The hardness of the wax will determine the effectiveness in improving abrasion resistance
- ***Coefficient of friction***
  - Many applications require the coated surface to slide against a stationary surface, which can occur during manufacturing or end use. Harder waxes are efficient in reducing the coefficient of friction
- ***Chemical resistance***
  - Waxes can aid in the resistance properties of a coating. Salt spray resistance of an exterior coating that will be exposed to severe weathering can be improved by adding a barrier wax
- ***Block resistance and release properties***
  - Waxes impart a non-stick character to a coating that decreases the tendency for blocking (unwated transfer or adhesion of coating)
- ***Influence on Gloss***
  - Waxes can be used to control gloss to achieve a desired matt effect. An example of this is satin finish coatings for wood

Printing Inks and Waxes

- ***Lithographic and letterpress inks***
  - High in viscosity and can be 'buttery' in consistency, formulated on slower-evaporating solvents
- ***Flexographic and gravure inks***
  - Very fluid (i.e. liquid inks), formulated on highly volatile solvents to allow the print to dry as quickly as possible
- ***Screen inks***
  - Viscosity intermediate between liquid flexographic/gravure inks and paste lithographic/letterpress inks
- ***Waxes in inks***
  - Almost all inks except inks that will be coated or laminated contain waxes
  - Waxes provide rub/scuff resistance, water/solvent or grease resistance and influence the coefficient of friction to control slip resistance
  - Waxes are supplied as micronized stir-in powders for oil/varnish compounds, oil dispersion for sheet fed and heat set inks, and water dispersion for water based flexo/gravure.
  - Waxes are used at less than 5% w/w with higher percentages in some emulsions/dispersions
  - Particle size is an important property for stir-in powders:
    - 4-6 microns is typical for sheet fed and high-speed heat set
    - Flexo/gravure can tolerate larger particle size (i.e. 6-20 microns)
  - Flexo and gravure inks are sometimes limited in the use of waxes because lower fractions can become soluble if the ink becomes to hot in manufacture.

Wax in Inks, Paints and Coatings

Characteristic	Inks	Powder	Can	Coil	Wood	Marine	Automotive
Rub/scuff/mar resistance	•		•	•			
Anti-blocking	•	•		•	•		
Water resistance	•				•		
Slip increase	•		•	•			
Lubrication (during manufacture)		•					
Grinding aid		•					
Reduced caking		•					
Flow additive		•					•
Product (content) release			•				
Higher coating flexibility			•				
Anti-weathering					•		
Water-mark resistance					•		
Barrier effect					•		
Maintenance aid						•	

Responsibilities

- ***Sales***
  - Responsible for all sales and marketing efforts related to the Wax business
  - Markets are Inks, Paints and Coatings mainly and potentially other markets
  - Territory is USA and Canada
- ***Metrics***
  - Maximize revenue and profits
  - Strong customer relations
  - Market Intelligence
  - Supply and Demand
- ***Data Analysis***
  - CRM (Customer Relationship Management)
  - IT
  - P2PR (Product to Production)

Glossary

- ***Compounding***
  - Dissolving a wax in a solvent and then rapidly cooling the solution with cold solvent (“shock cooling”)
- ***CRM***
  - Customer Relationship Management
- ***Dispersing***
  - Mixing solid waxes into a vehicle (oil, solvent or water) using different media mills
- ***Emulsifying***
  - Preparing a very fine particle size dispersion of a solid wax in water with the addition of emulsifiers
- ***P2PR***
  - Product to Production

Background

John Smith

Technical Sales Manager
The Specialty Chemicals Company

MBA: Marketing *(Honor Society)*
BS: Engineering

- 5 Publications
- Sales of $5 Million a year
- Winner of SCC President Award

Marketing, Sales and Technical Expert in Specialty Chemicals