Fischer-Tropsch lubricants for PVC: Innovations toward sustainable solutions

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SAFELY DELIVERING TODAY,
SHAPING TOMORROW

Sasolburg FT plant, South Africa

About Sasol

Sasol is a global integrated chemicals and energy company

Through our more than 29 000 talented people, we harness our knowledge and experience to integrate sophisticated technologies and processes into our world-scale operating facilities. We safely and sustainably source, produce and market a range of high-value product streams in 22 countries, creating superior value for our customers, shareholders and other stakeholders

Sasol group structure

BUSINESS OF TODAY & THE FUTURE OPERATING MODEL

SOUTHERN AFRICA ENERGY & CHEMICALS

LEADING THE ENERGY TRANSITION IN SOUTHERN AFRICA

INTERNATIONAL CHEMICALS

GROWING WITH OUR UNIQUE CHEMISTRY

BUSINESS SUPPORT

SAFELY DELIVERY TODAY

FUTURE FOCUS

SHAPING TOMORROW

Enabled by

Delivering safely today	**Unlocking** operational and commercial synergies	**Inspiring** our highly skilled and talented people	**Leveraging** our unique FT technology	**Future focus** shaping tomorrow

Markets and applications for wax additives

Construction board

Hot melt adhesives

Polymer processing

Rubber and tyre

Candles

Industrial coatings

Flexible packaging

Asphalt modification

Chemicals

Cosmetic and pharmaceutical

Inks

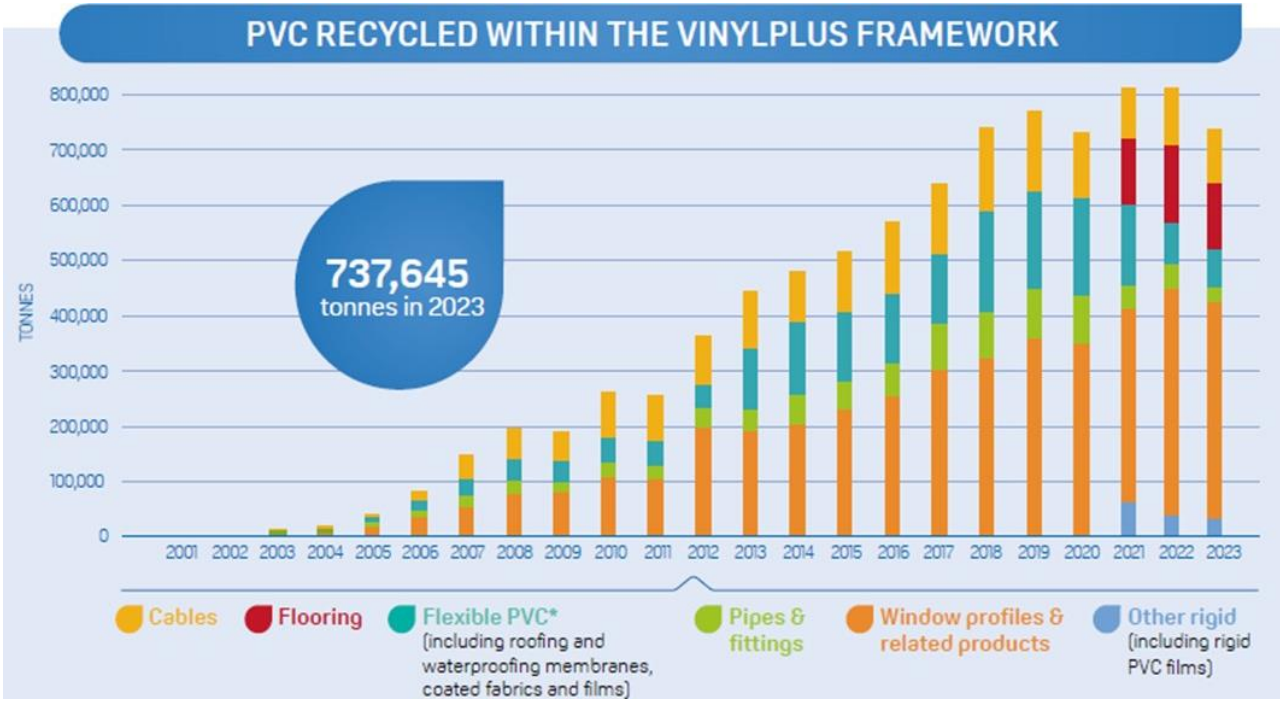
… and many others

Presentation outline

- PVC and PVC additives:
  the challenges and opportunities
- FT in PVC lubrication
- Advances in CPVC lubrication
- The journey towards more sustainable lubricants

PVC and PVC additives: The challenges

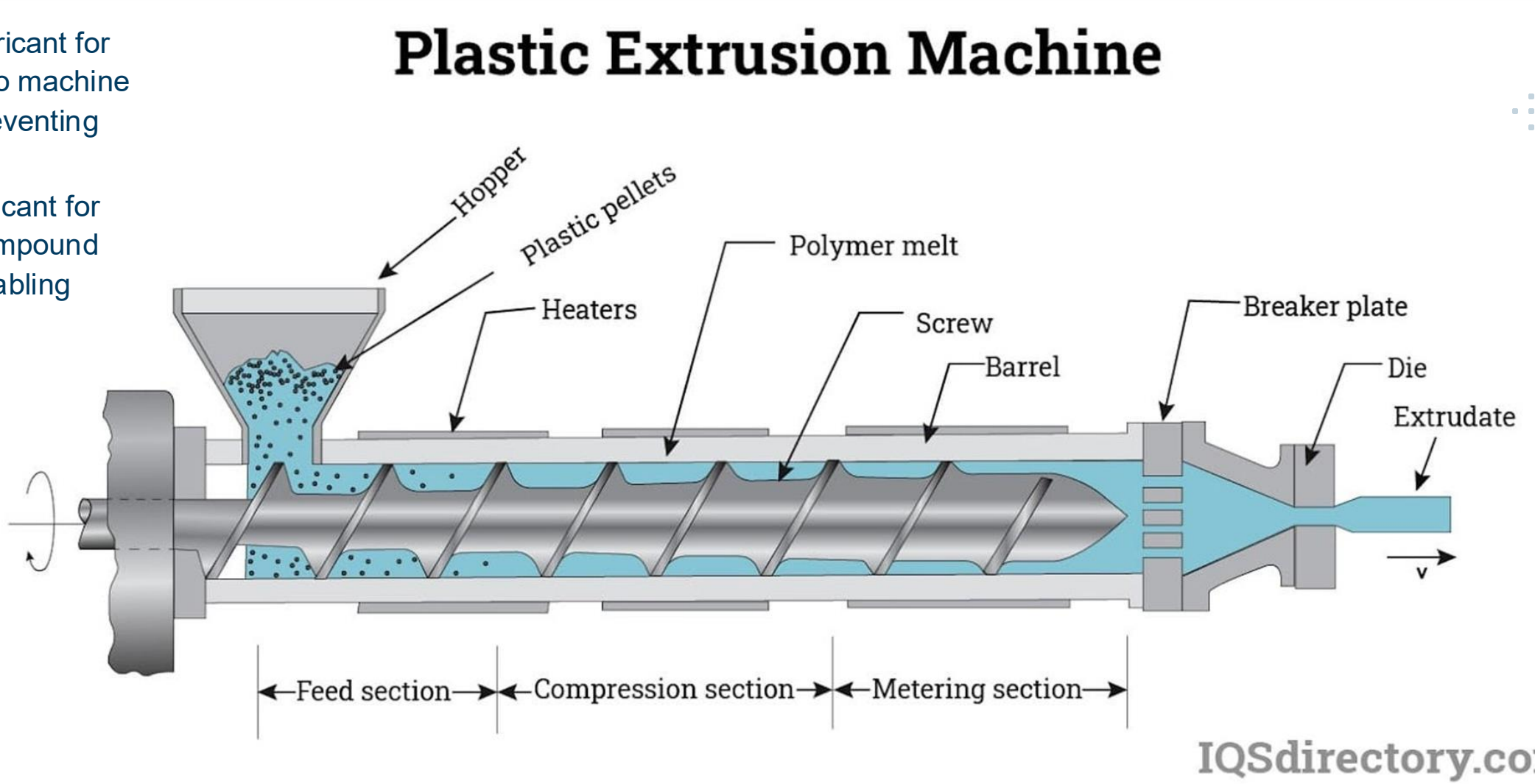
- PVC industry predominantly durable articles, yet pressure remains to reduce its carbon footprint
- Window frames and pipe lifespans exceeding 20 years
- PVC recycling and legacy additives
- Oleochemicals as internal lubricants, and Ca/Zn stabiliser could be produced from renewable sources
  - Negatives may include lower thermodynamic stability than synthetic products
- External lubricants mostly fossil-derived chemistry



PVC lubrication

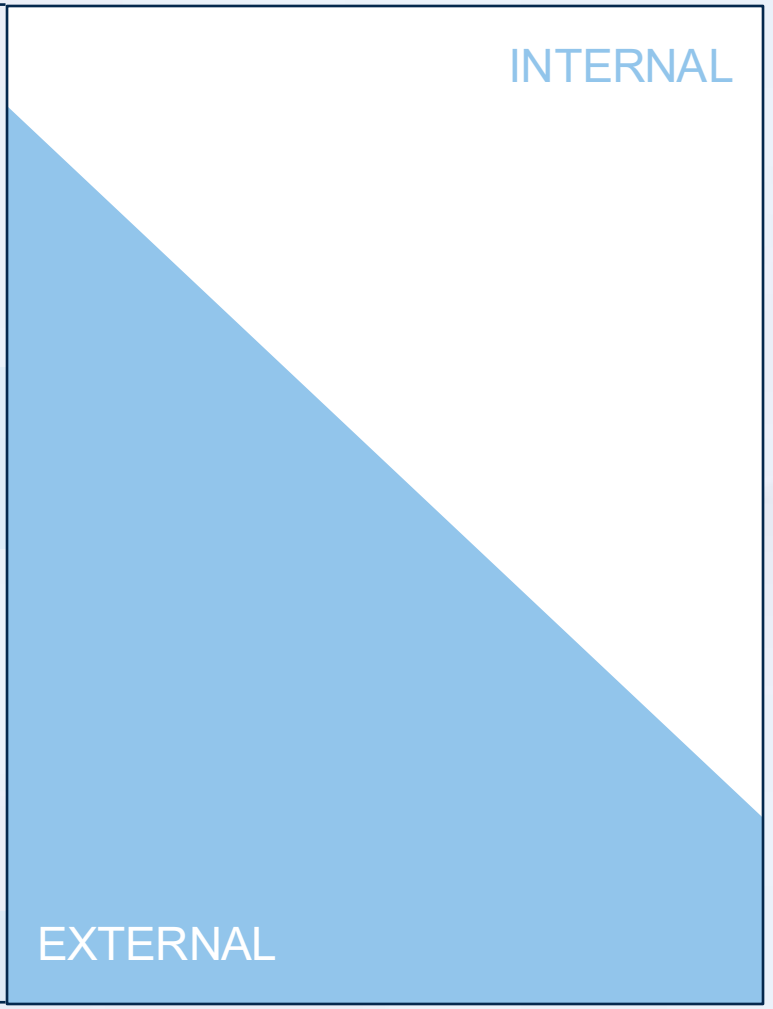
Required

- External lubricant for compound to machine interface preventing sticking
- Internal lubricant for reducing compound viscosity enabling processing



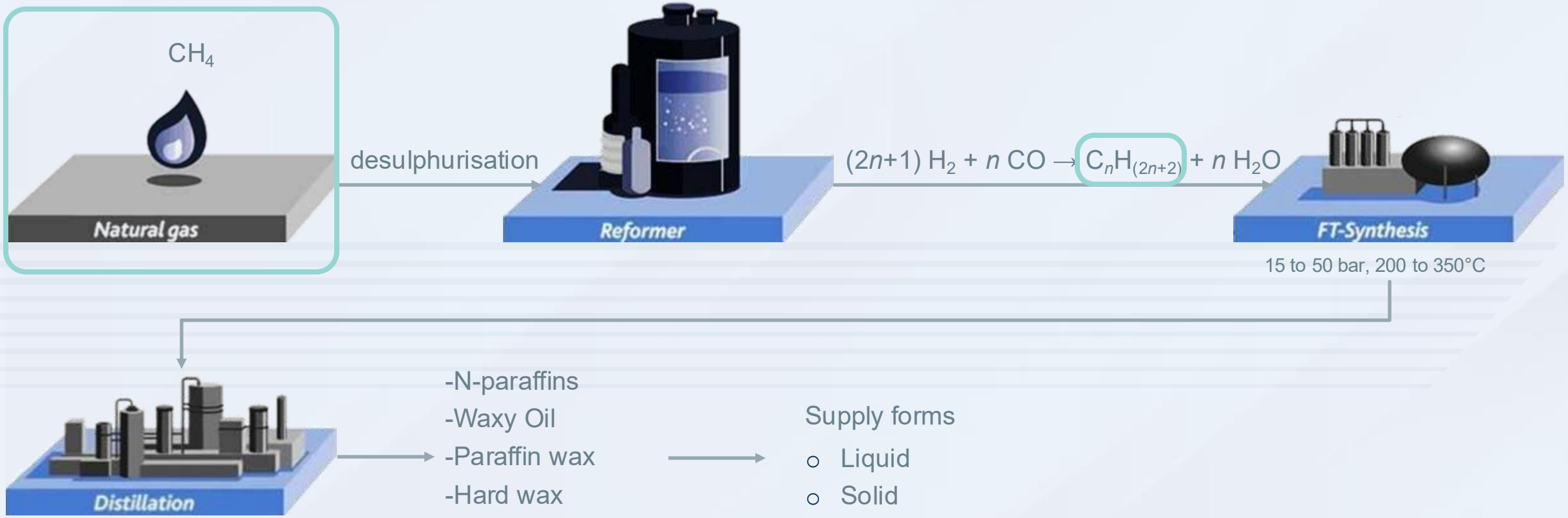
Classes of lubricants for PVC processing

Fatty acid esters	C13-C18	-COO-
Metal soaps	C16-C18	-COO-M
Amide waxes	C16-C18	-CO-NH-CO-
Ester waxes	C6-C22	-COO-
Oxidised Sasol Fischer-Tropsch wax	proprietary	-COO- -COOH -COH
Oxidised PE	C125-C600	Various
Paraffin (liquid)	C10-C18	Highly branched
Paraffin wax (solid)	C25-C36	Less branched
PE wax	C125-C850	Branched
FT Waxes	C50-C130	Linear

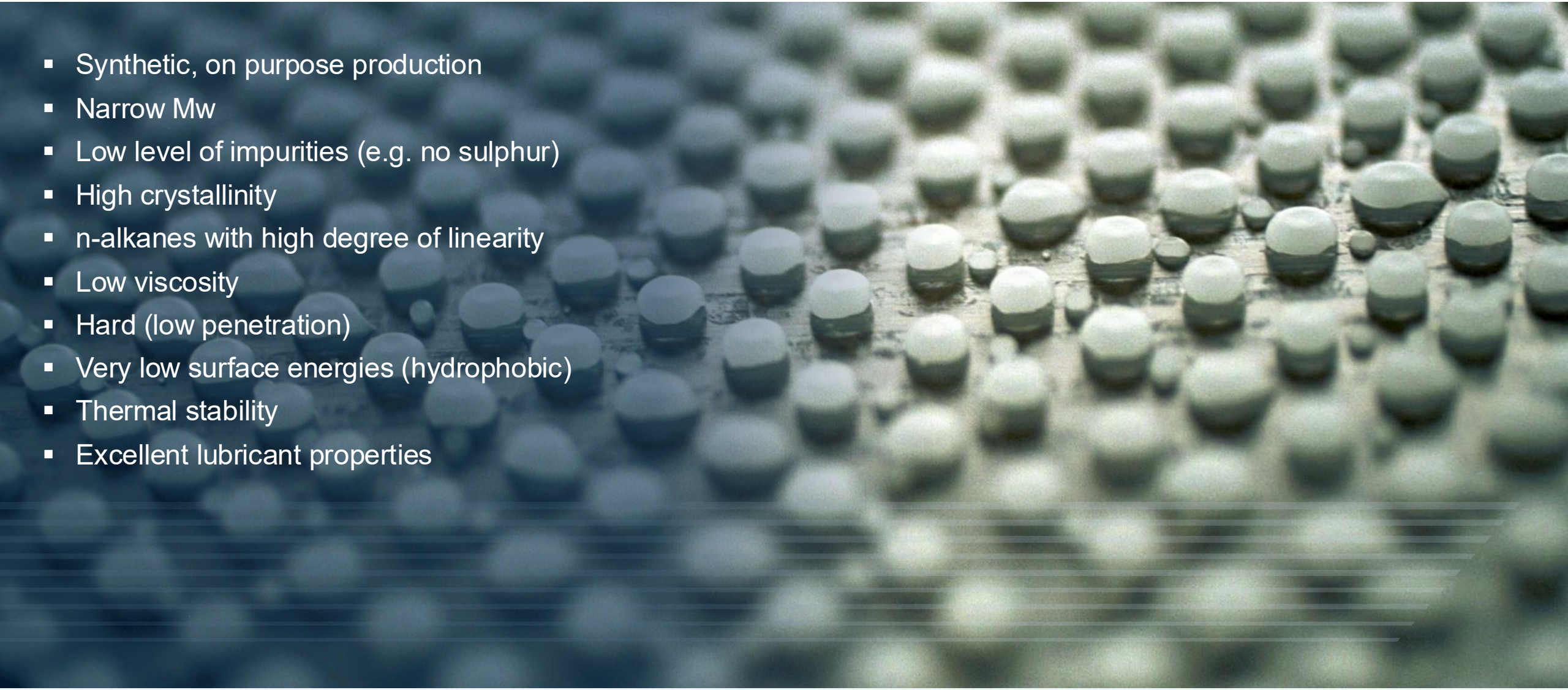


Sasol Fischer-Tropsch Process:
On purpose production of hard waxes (C1 chemistry)

Sustainability of NG



Unique properties of Sasol FT hard wax

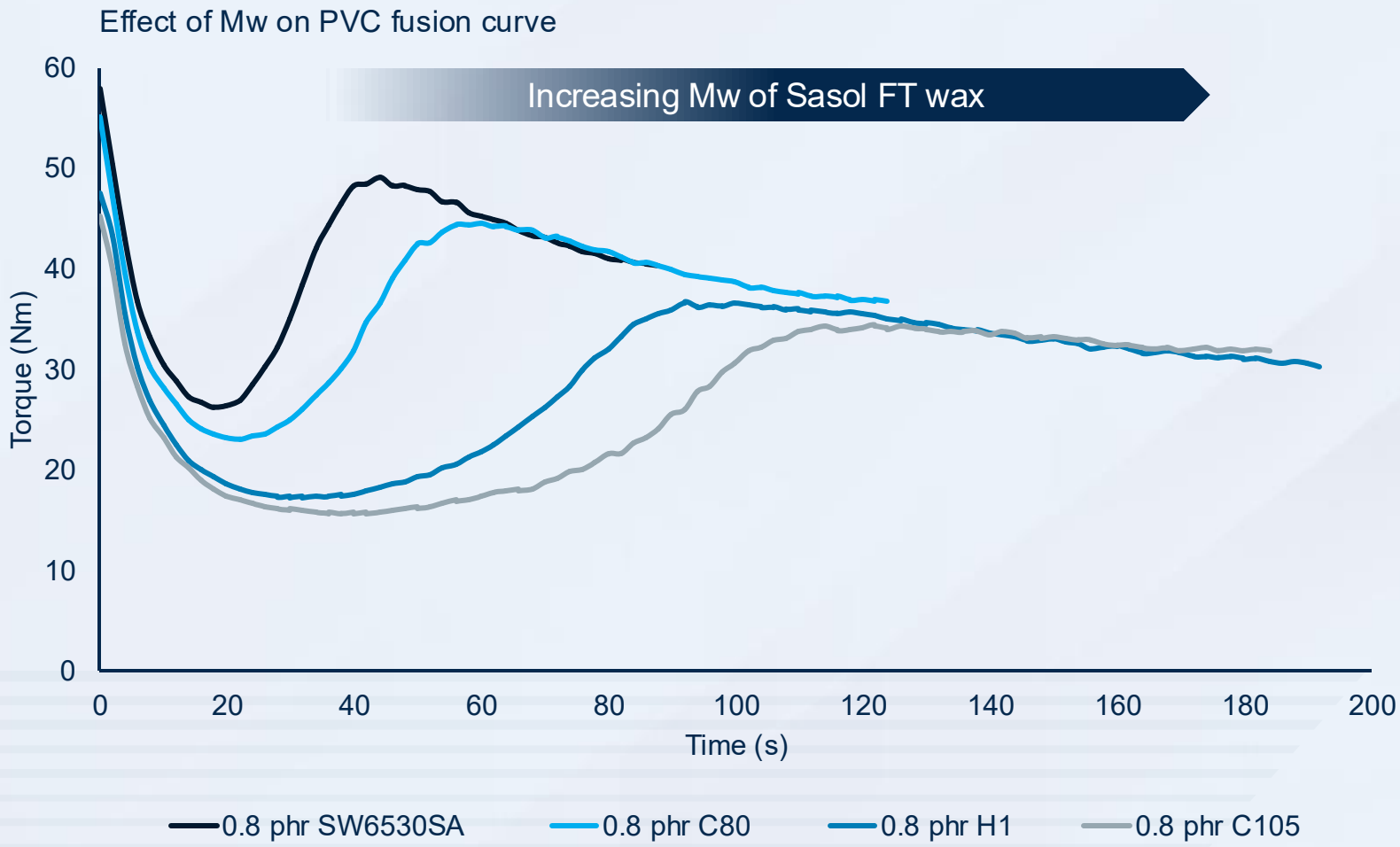


- Synthetic, on purpose production
- Narrow Mw
- Low level of impurities (e.g. no sulphur)
- High crystallinity
- n-alkanes with high degree of linearity
- Low viscosity
- Hard (low penetration)
- Very low surface energies (hydrophobic)
- Thermal stability
- Excellent lubricant properties

Formulating with Fischer-Tropsch waxes in PVC

Effect of Molecular Weight as lubricant at same concentration

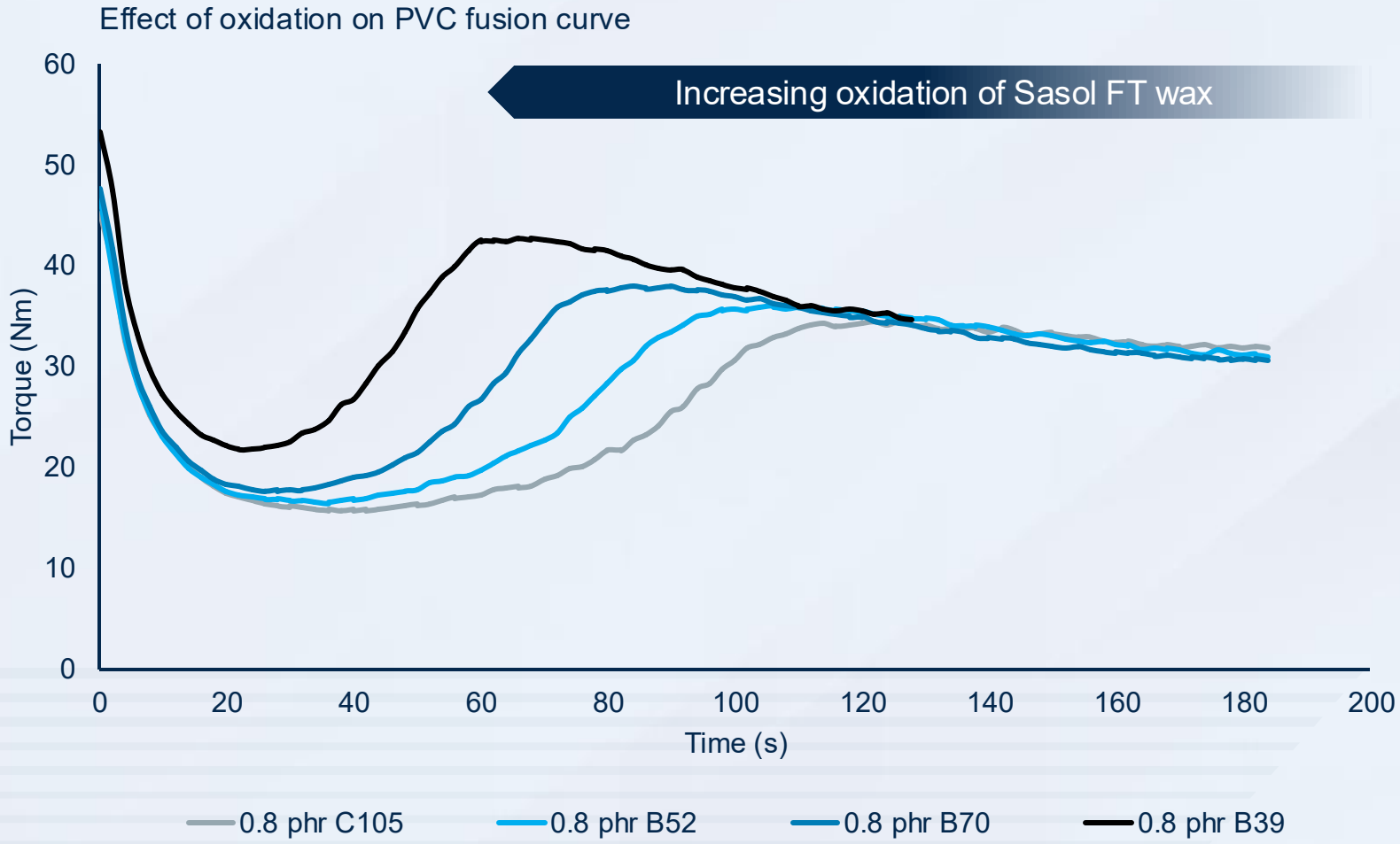
- Higher Mw FT wax
  - FT provides lower equilibrium torque
  - Enables an output efficiency gain
  - Reduction of peak torque at fusion
  - Potential to reduce wax phr
  - Up to 40% less wax
- Lower Mw FT wax
  - Allows for increased work of the compound
  - Help with earlier gelation



Formulating with Oxidised FT waxes

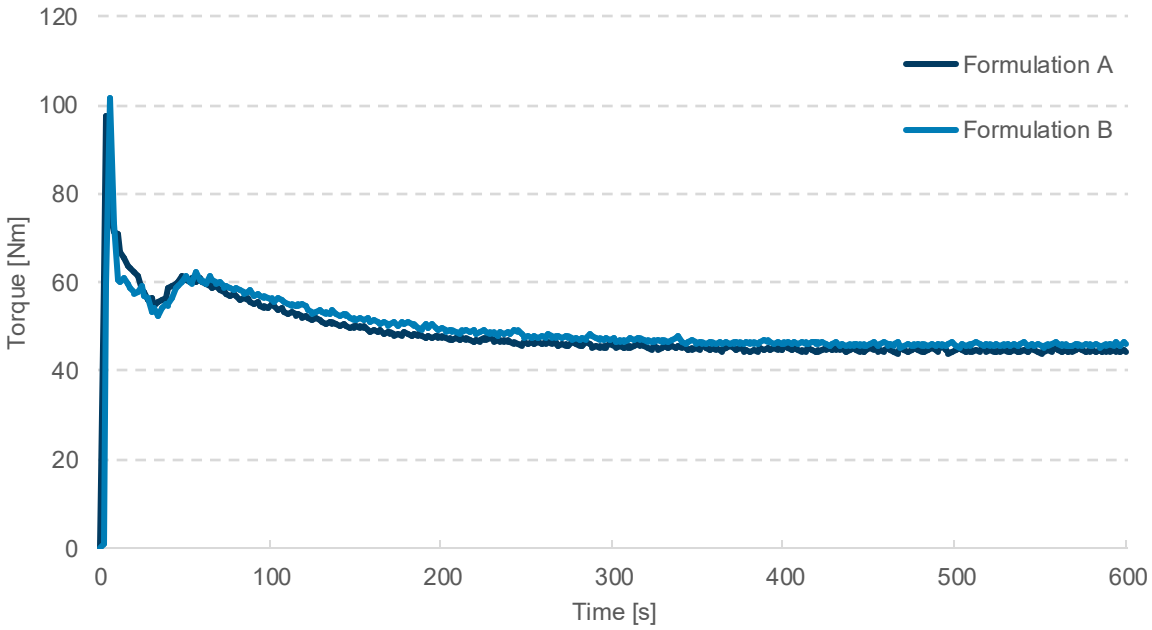
Effect of adding polarity and functional groups

- Oxidising Sasol Fischer Tropsch wax:
  - Changes the wax character by adding polarity
  - The polarity provides versatility when formulating CaZn and Organic systems
  - Improved metal release and gloss
  - Melt flow and pressure can be modified
  - Potential reduction of oleochemical lubricants such as esters, acids, amides and montan derivatives
  - Benefits of OxFT in high filler compound for dispersion of $CaCO_3$



Formulating with B39 series waxes in CPVC

Raw material (phr)	Reference Formulation (A)	Sasolwax Formulation (B)
CPVC	100	100
MBS	6	6
OPE	0.4	0.4
Antioxidant	0.5	0.5
TiO_2	2	2
Tin Stabilizer	3	3
Processing aid	3	3
Reference Lubricant solution	1.7	/
Sasolwax B391 solution	/	**1.0**
Sub total	116.6	115.9



Sample	Fusion Time [s]	Fusion Torque [Nm]	Equilibrium Torque [Nm]
Formulation A	48	44.8	60.1
Formulation B	48	46.4	60.1

Sasolwax B39 series offers the best lubrication choice for PVC lubrication

- Reduces the wax dosage compared to alternatives
  - More efficient lubrication
  - Balanced external/internal lubrication

The journey towards more sustainable synthetic lubricant additives

Purpose

Innovating for a better world

Values

Be: Safe | Caring | Inclusive
Accountable | Resilient

Our commitment to a decarbonised future

REDUCE → Energy & process efficiency and RE

TRANSFORM → Feedstock replacement

SHIFT → New low carbon value pools

2030 levers

- Align GHG and environmental compliance
- Increase gas intake
- Reduce coal demand
- Scaling up Renewable Energy
- Optimising our portfolio
- Energy and process efficiency

levers to achieve net zero

- CO_2 removal technology (CDR) & sequestration
- Hydrogen and sustainable carbon
- Carbon offsets (high quality CDR)
- Alternative feedstocks
- Advantaged FT technology
- Emerging technologies

Our base 2017 → **30% target 2030** → **Net Zero ambition 2050**

1. Scope 1 and 2 emissions, off 2017 base | 2. Net zero is for scope 1, 2 and 3 (Category 11) for Energy and scope 1 and 2 forChemicals

Sustainability | Our roadmap to transformation

Scope 1 and 2	Raw material transition	Product innovation	New technology
▪ Increase usage of renewable electricity ▪ Improve operational efficiencies ▪ Electrification for heat generation	▪ Introducing circular and renewable feedstocks ▪ Enabling Mass Balanced (MB) solutions across all sites ▪ Demonstrate the impact of MB solutions with data modelling	▪ R&D lead collaborations ▪ Utilising our full product portfolio to find solutions ▪ Partnering via formal technical collaborations	▪ Successful track record in commercialisation ▪ Actively seeking out new technology partnerships ▪ Focus across the full value chain (raw materials, intermediates and final products)

No silver bullet – we required multiple solutions to enable a successful transition

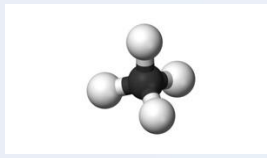
Fischer-Tropsch process: carbon and hydrogen feedstock options

CARBON feedstock → **FT** synthesis → **OUTPUT** FT wax

2030 levers

levers to achieve net zero

$C_{169}H_{128}O_{10}N_2S$
H:C ≈ 1:1.3

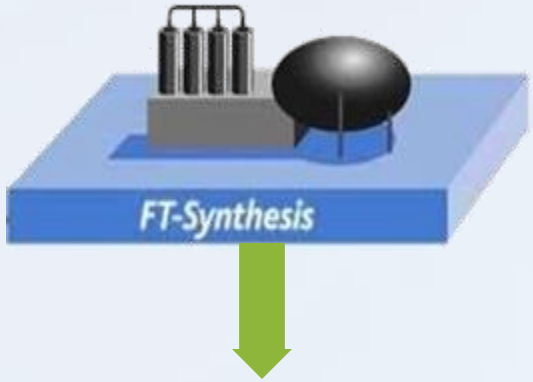


CH_4
H:C = 4:1

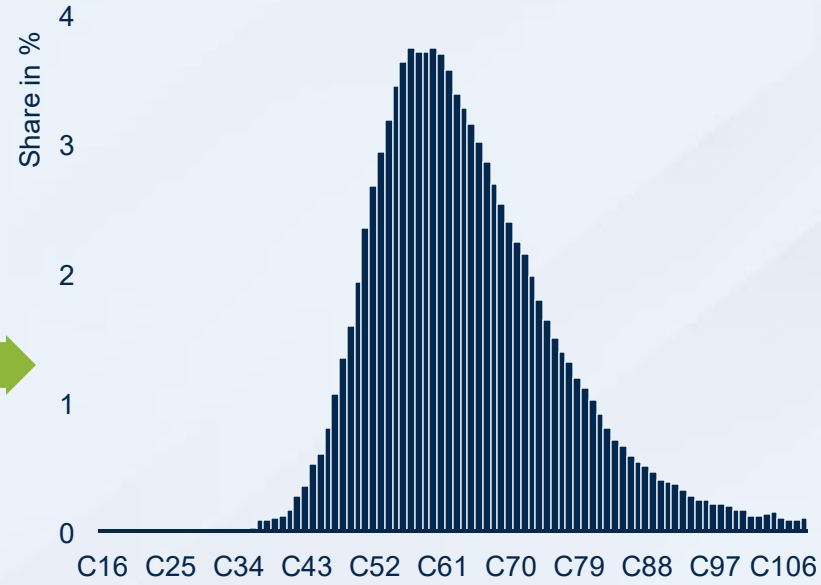
$(C_6H_{10}O_5)_n$
H:C ≈ 1.7:1

CO_2
H:C ≈ 0:1

$(2n+1)H_2 + nCO \rightarrow C_nH_{2n+2} + nH_2O$
H:C ≈ 4:1



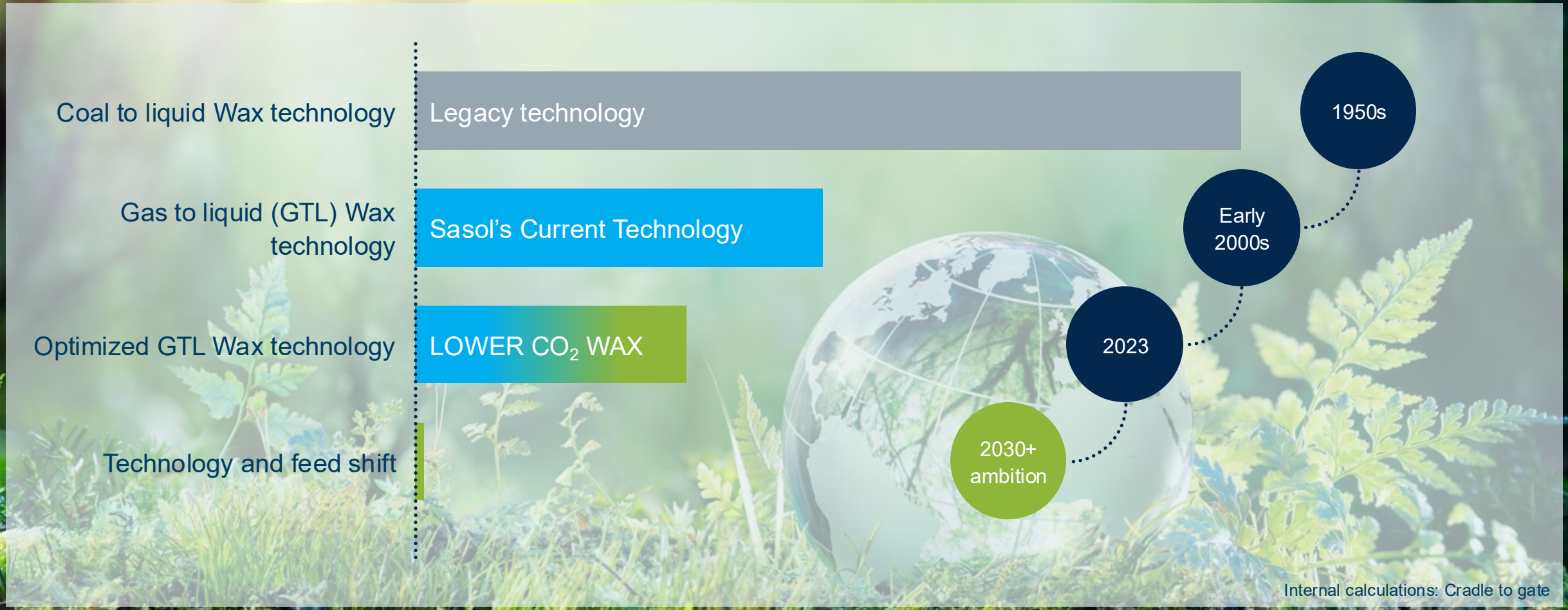
Other FT products



FT hard wax C_nH_{2n+2}
H:C ≈ 2:1

Improving the FT wax CO_2 footprint

Cradle-to-Gate Product Carbon Footprint data in mt CO2 eq./mt of product
Reference : Internal high-level estimated and calculated** PCF data for* ***Sasolwax H1 & equivalent, Sasolwax LC 100 F***



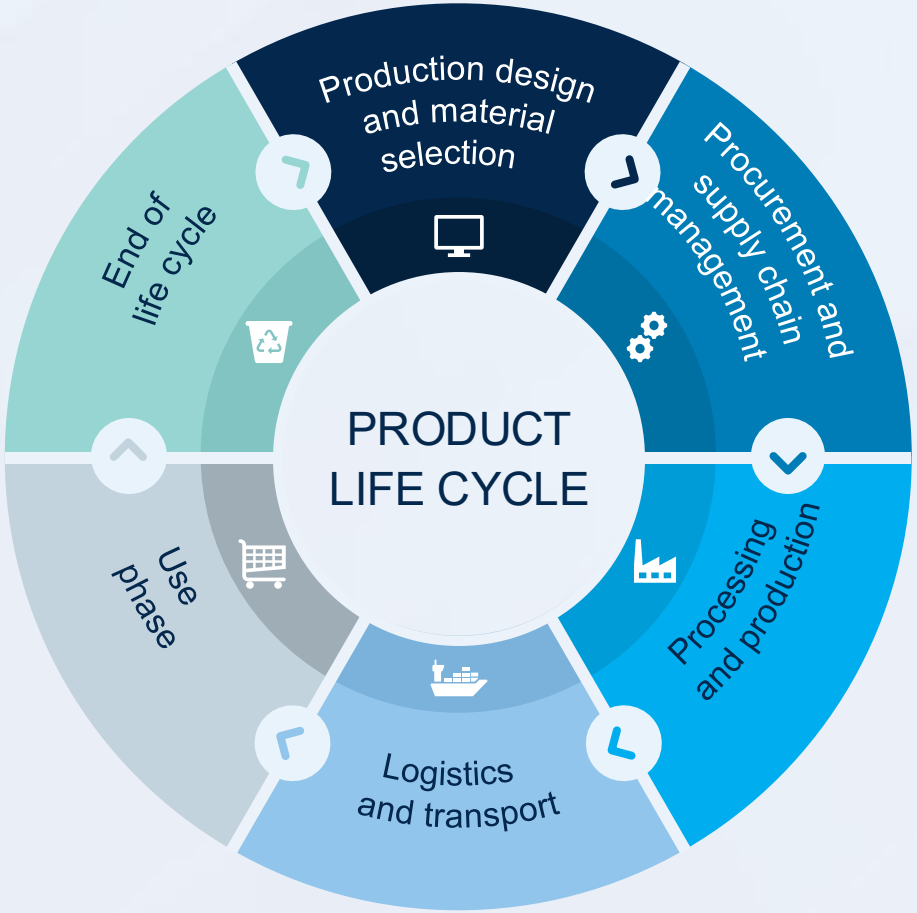
Improving downstream customers sustainability

Sasol continuously strives to develop products that improve performance for Polymer convertors

Sasol commercialising new products with up to 30% lower PCF in 2023

'Invisible' drop-in solution with a very low carbon footprint

How FT waxes can contribute to more sustainable PVC processing



- Higher output
- Lower energy
- More recycling
- Longer lifespan

Can synthetic PVC lubricant additives be more sustainable in future?

- Renewable feedstocks
- Renewable Energy
- Products with lower PCF than CTL or GTL available now!
- Journey has begun
- Several possibilities to produce additives more sustainably
- The journey will depend on customer demand and legislation
- Vastly lower PCF products are in development thanks to adapting feedstocks

YES!!!

Gaurav Verma reposted this

Sasol Chemicals
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19h • Edited •

Discover Sasol's latest innovation at PVC Formulation North America 2025!

We are delighted to announce that Sasol will be exhibiting at PVC Formulation North America, taking place on 25-26 February 2025, in Cleveland, OH, USA. This premier event will cover the latest market trends, sustainability advances, and technological innovations within the PVC industry.

At Sasol, we are proud to contribute to the advancements in polymer additives. Our ongoing commitment to innovation focuses on developing products that not only meet the rigorous demands of polymer and rubber processing but also contribute to a more sustainable future.

Introducing SASOLWAX LC 100 F: We are excited to unveil SASOLWAX LC 100 F, a new Fischer-Tropsch Hard Wax with a 35% lower product carbon footprint than natural gas-derived Fischer-Tropsch wax and significantly lower than Coal-derived Fischer-Tropsch Hard Wax. SASOLWAX LC 100 F has been developed as an excellent external lubricant for use during PVC processing. Its linear molecular structure and low viscosity ensure ideal processing of the PVC material.

Disclaimer - Forward-looking statements

These statements may also relate to our future prospects, expectations, developments and business strategies

Sasol may, in this document, make certain statements that are not historical facts and relate to analyses and other information which are based on forecasts of future results and estimates of amounts not yet determinable. These statements may also relate to our future prospects, expectations, developments, and business strategies. Examples of such forward-looking statements include, but are not limited to, the capital cost of our projects and the timing of project milestones; our ability to obtain financing to meet the funding requirements of our capital investment programme, as well as to fund our ongoing business activities and to pay dividends; statements regarding our future results of operations and financial condition, and regarding future economic performance including cost containment, cash conservation programmes and business optimisation initiatives; recent and proposed accounting pronouncements and their impact on our future results of operations and financial condition; our business strategy, performance outlook, plans, objectives or goals; statements regarding future competition, volume growth and changes in market share in the industries and markets for our products; our existing or anticipated investments, acquisitions of new businesses or the disposal of existing businesses, including estimates or projection of internal rates of return and future profitability; our estimated oil, gas and coal reserves; the probable future outcome of litigation, legislative, regulatory and fiscal developments, including statements regarding our ability to comply with future laws and regulations; future fluctuations in refining margins and crude oil, natural gas and petroleum and chemical product prices; the demand, pricing and cyclicality of oil, gas and petrochemical product prices; changes in the fuel and gas pricing mechanisms in South Africa and their effects on prices, our operating results and profitability; statements regarding future fluctuations in exchange and interest rates and changes in credit ratings; total shareholder return; our current or future products and anticipated customer demand for these products; assumptions relating to macroeconomics; climate change impacts and our climate change strategies, our development of sustainability within our businesses, our energy efficiency improvement, carbon and greenhouse gas emission reduction targets, our net zero carbon emissions ambition and future low-carbon initiatives, including relating to green hydrogen and sustainable aviation fuel; our estimated carbon tax liability; cyber security; and statements of assumptions underlying such statements. Words such as “believe”, “anticipate”, “expect”, “intend", “seek”, “will”, “plan”, “could”, “may”, “endeavour”, “target”, “forecast” and “project” and similar expressions are intended to identify forward-looking statements but are not the exclusive means of identifying such statements. By their very nature, forward-looking statements involve inherent risks and uncertainties, both general and specific, and there are risks that the predictions, forecasts, projections, and other forward-looking statements will not be achieved. If one or more of these risks materialise, or should underlying assumptions prove incorrect, our actual results may differ materially from those anticipated. You should understand that a number of important factors could cause actual results to differ materially from the plans, objectives, expectations, estimates and intentions expressed in such forward-looking statements. These factors and others are discussed more fully in our most recent annual report on Form 20-F filed on 6 September 2024 and in other filings with the United States Securities and Exchange Commission. The list of factors discussed therein is not exhaustive; when relying on forward-looking statements to make investment decisions, you should carefully consider foregoing factors and other uncertainties and events, and you should not place undue reliance on forward-looking statements. Forward-looking statements apply only as of the date on which they are made, and we do not undertake any obligation to update or revise any of them, whether as a result of new information, future events or otherwise.

Comprehensive additional information is available on our website: www.sasol.com

THANK YOU!

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