INTERNATIONAL LATEX CONFERENCE 2021

INNOVATIONS AND SUSTAINABILITY IN NATURAL RUBBER LATEX THE NEW PARADIGM

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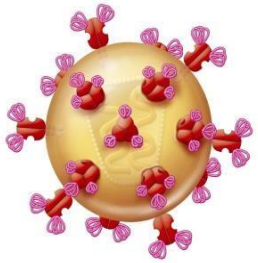
PRESENTATION FORMAT

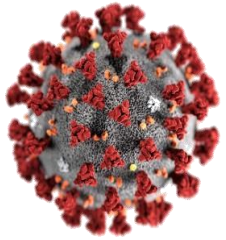
1. OPENING REMARKS AND INTRODUCTION
2. OVERVIEW AND CURRENT SUPPLY-DEMAND TRENDS
3. THE ULTRA LOW PROTEIN LATEX AND DEPROTEINISED NATURAL RUBBER PLATFORM
4. INNOVATION AND TECHNOLOGY TRENDS IN SPECIALITY NATURAL RUBBER AND LATEX COLLABORATIONS AND COOPERATION
5. THE BROADER PERCEPTIONS OF NR SECTORAL SUSTAINABILITY CHALLENGES
6. CONCLUDING REMARKS

AN HISTORICAL PERSPECTIVE - FLASHBACK IN TIME -1988

Surgeon General C. Everett Koop



Human Immunodeficiency Virus (HIV)



Coronavirus disease 2019 (COVID-19)

EXTRACTS OF MESSAGE FROM SURGEON GENERAL, USA
REPORT TO THE AMERICAN PUBLIC ON HIV INFECTION AND AIDS – MAY 05,1988

***AIDS**--Acquired immunodeficiency syndrome--is now the epidemic of our generation, invading our lives in ways we never imagined-- testing our scientific knowledge, probing our private values, and sapping our strength.*
AIDS no longer attracts our attention--it commands it.

About 1 million Americans (1 out of every 250) are now infected with Human Immunodeficiency Virus (HIV), the virus that causes AIDS. .. …." The truth is that AIDS is everyone's problem. Because so many people are infected with HIV, all of us who share our fragile humanity are also affected--if not by the virus itself, then by those devastating companions of AIDS—
fear, loss, sorrow, denial, and prejudice.

*"**We must face our fears squarely and shed our false beliefs about HIV and AIDS**……"*

---

*This presaged what was the genesis of the **"Great Glove Rush"** of the 1988-1992 period. Glove usage rose to 10 Billion pieces. There is a similar dilemma 32 years later. Just replace **HIV** and **AIDS** by **CORONA VIRUS** and **COVID-19***

In the intervening years we have experienced other deadly viruses, though of less potent transmissibility
SARS, MERS, NIPAH, H5N1 & EBOLA.
This contributed to an expanding global awareness of the use of LATEX PRODUCTS for PROTECTION and PROPHYLAXIS.
In 2020 global Glove demand jumped to *330 billion pieces for* a "***Mega Glove Rush***"

OPENING REMARKS AND INTRODUCTION

- After ILC 2019 - The dramatic effect of the pandemic impacted both the Natural Rubber growing and consuming regions. Recovery has been slow but ongoing.

- The acute short term shortages of gloves and elastomeric medical products highlighted the skewed supply chain.

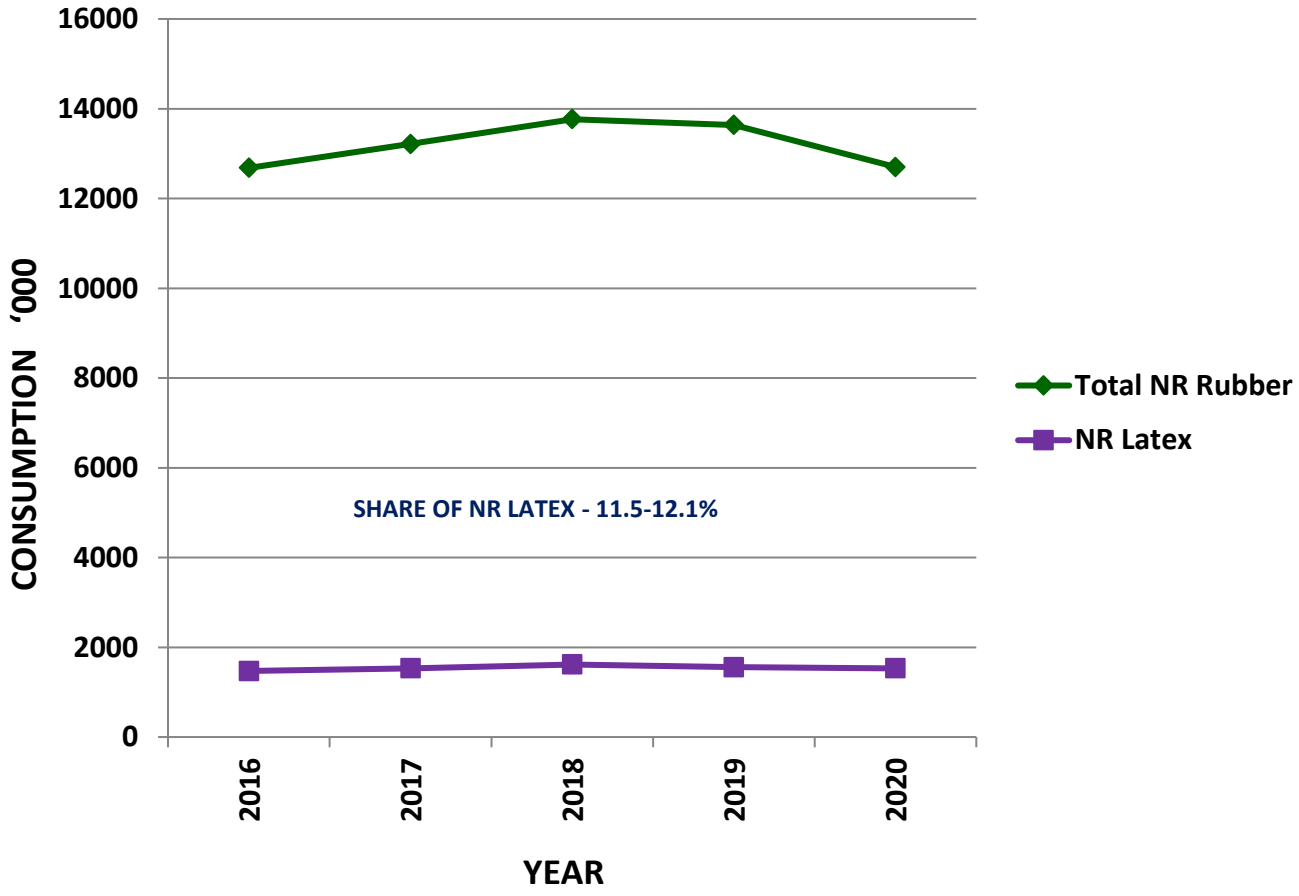
- This has resulted in strategy and policy shifts in supply chain management – re-establishing domestic manufacturing capability, restoring greater geographic diversification of latex processing and product manufacturing.

- Incremental Innovations - through upstream Natural Rubber bioelastoplastic modifications seek to target the niche space of select speciality synthetic polymers for tyres .
  The R&D association with IRMRA promises quicker laboratory and field based testing and evaluations downstream.

- At Vystar, the recalibrated sustainability programme (FSC, nitrosamines & ammonia free, ultralow proteins, no SVHC and green carbon neutrality) emphasize certifications with Corrie MacColl market reach facilitating faster rollouts.

- Non traditional/non *Hevea brasiliensis* based production efforts are likely to continue to face new penetration and high cost-benefit acceptance challenges in this decade.

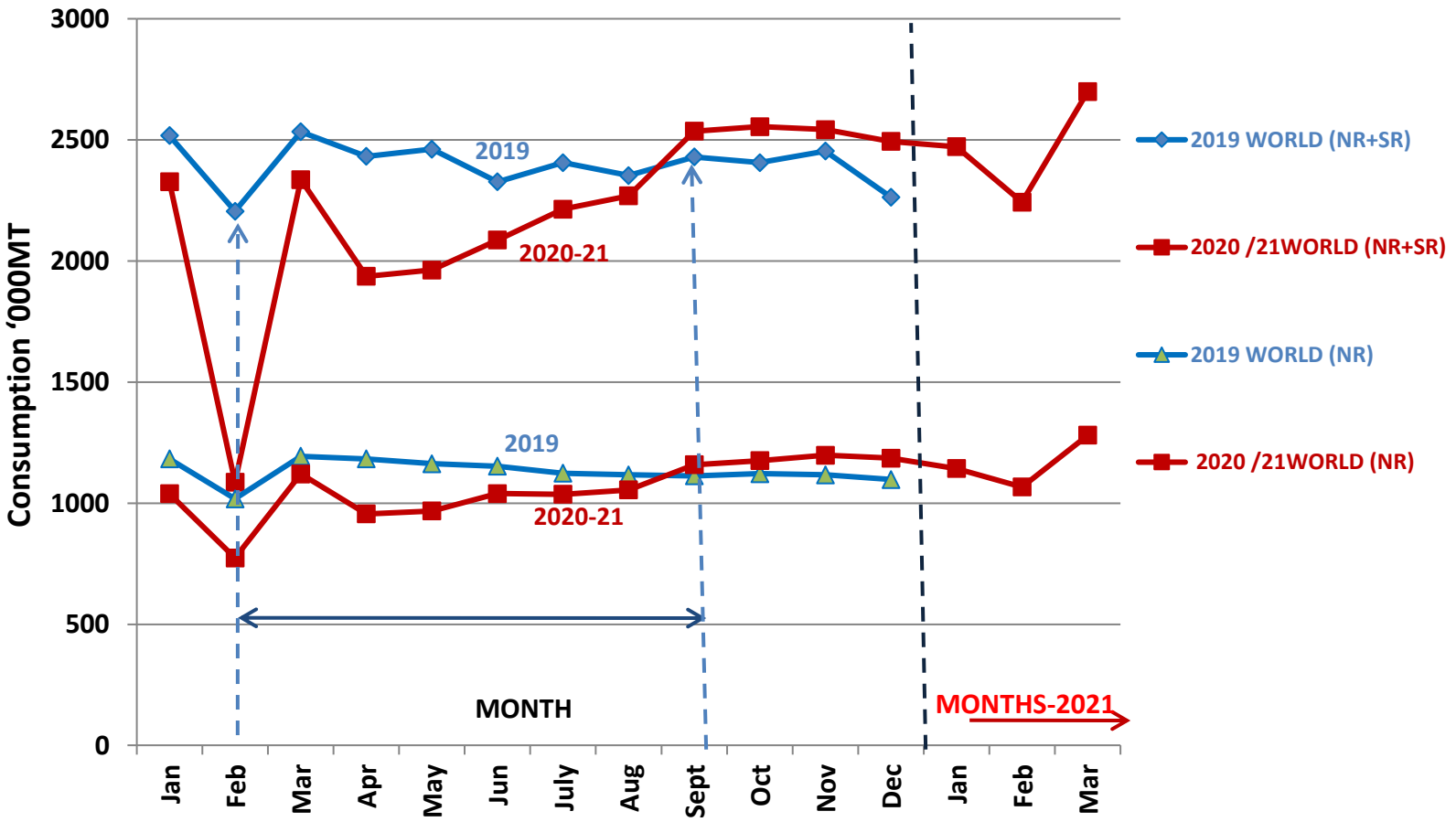
OVERVIEW AND CURRENT SUPPLY-DEMAND TRENDS



A fact not often recognised is that the latex segment constitutes the second largest sector (quantity/value) after automotive tyres (60-65%).

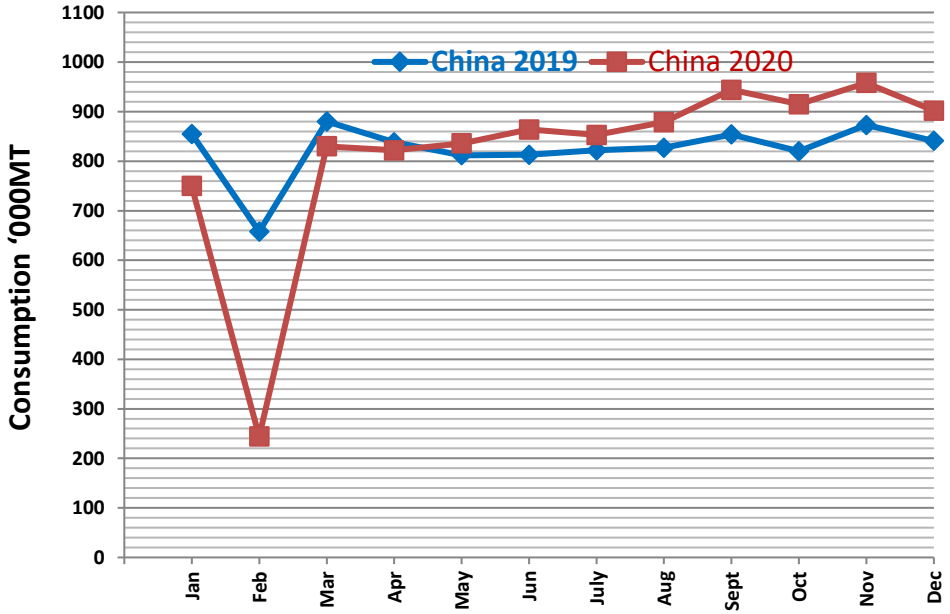
Source: IRSG Statistics

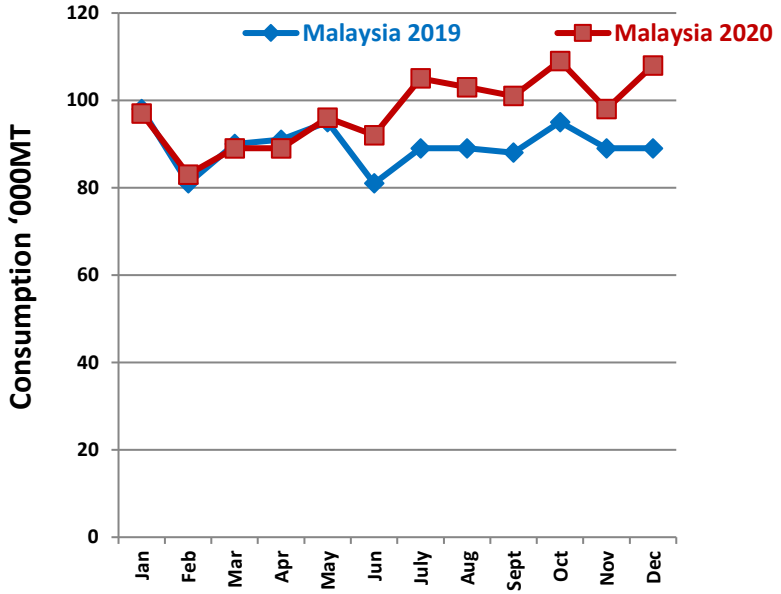
THE PANDEMIC IMPACT ON WORLD NR+SR TRENDS [2019-2021(Q1)]

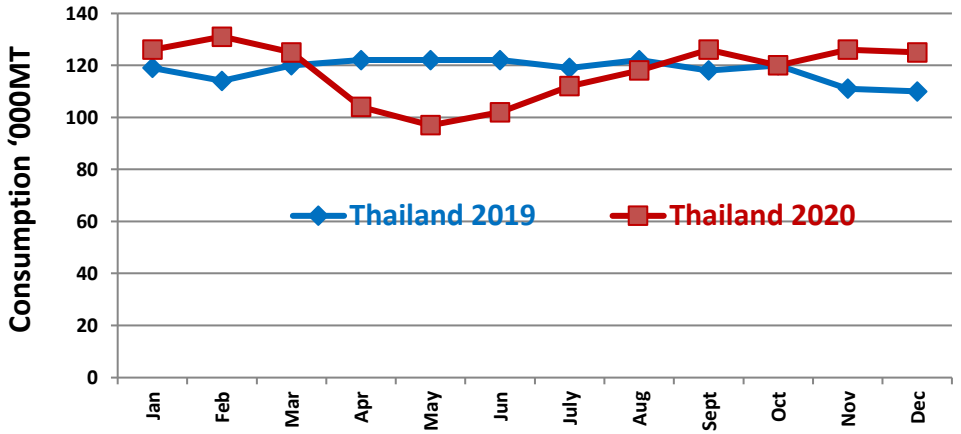


Source: IRSG Statistics

COUNTRY WISE IMPACT ON NR+SR TRENDS [2019-2020]

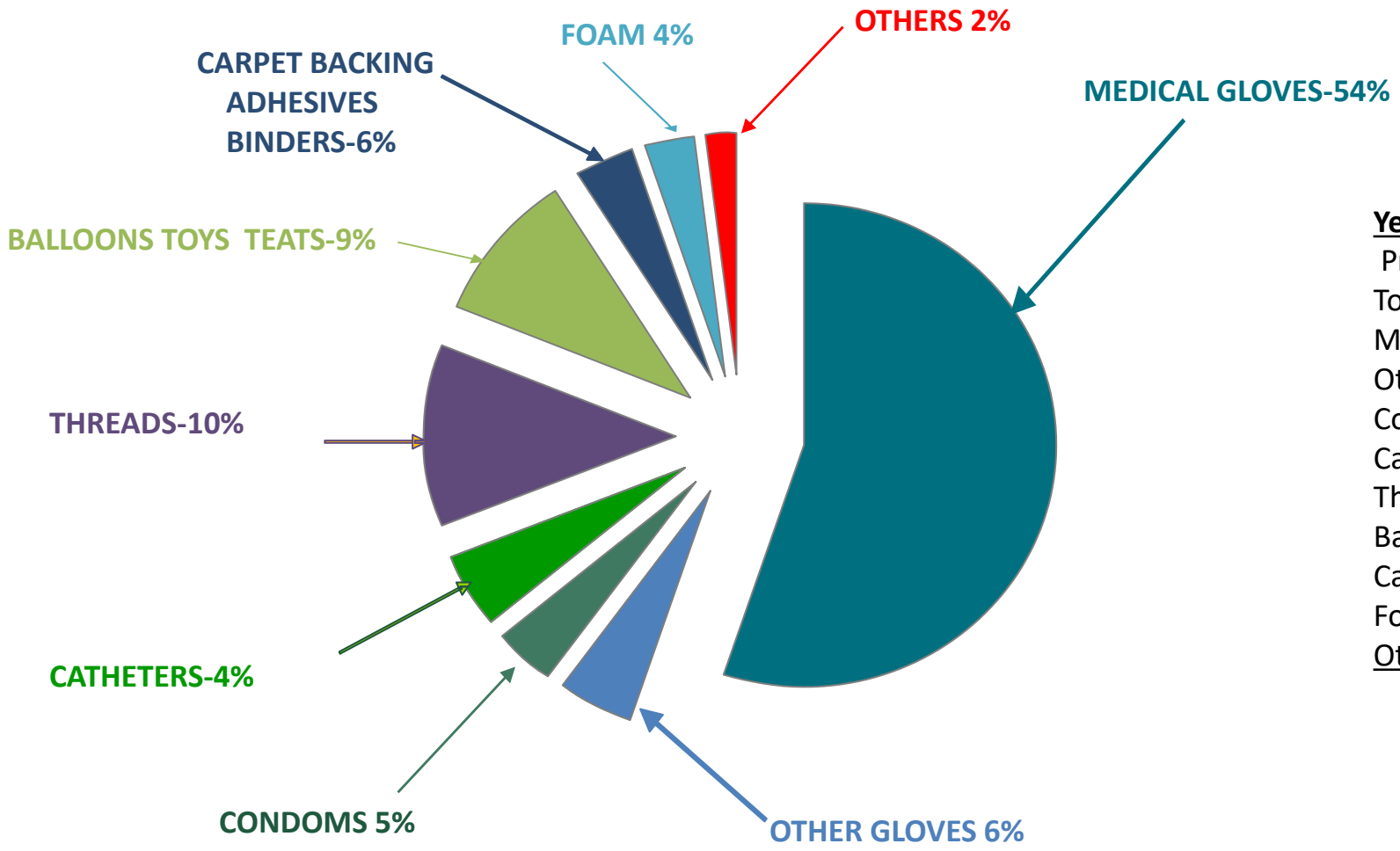






Source: IRSG Statistics

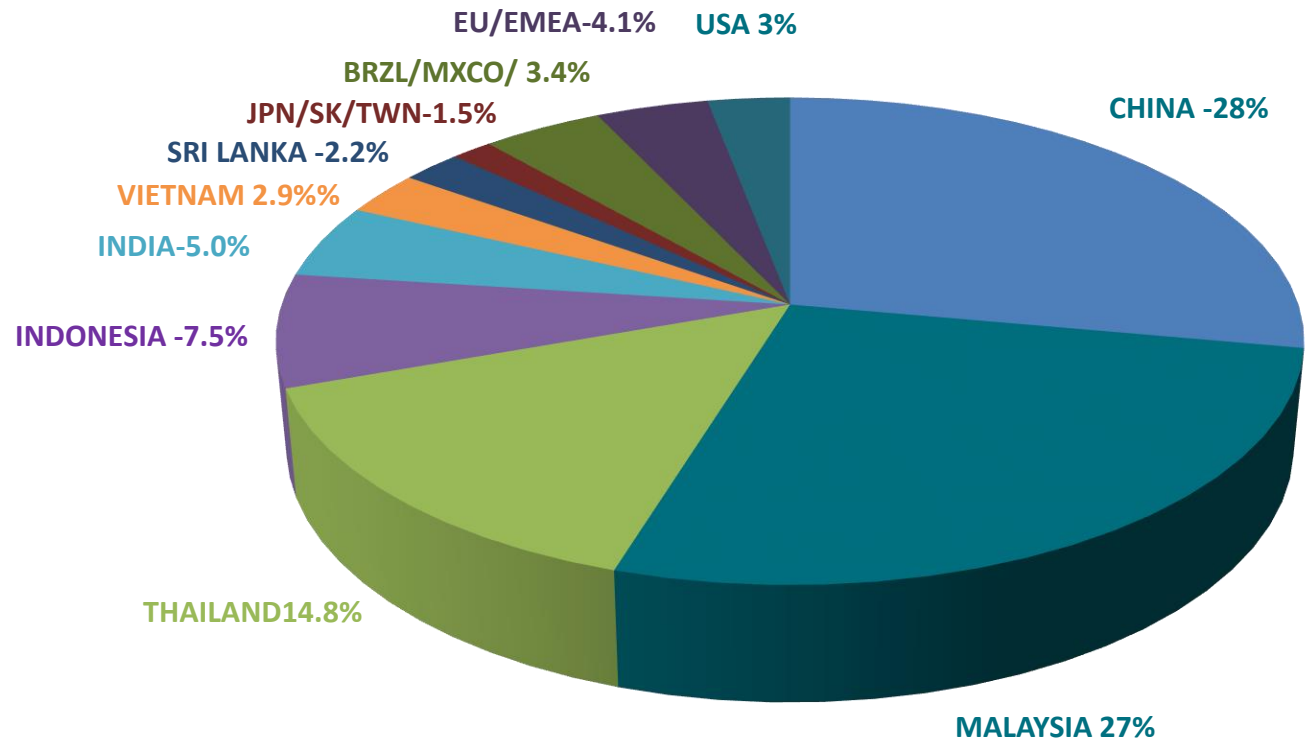
LATEX PRODUCT INDUSTRY SEGMENTATION



Year 2020	NR Latex
Product	(MT)
Total	1,532,000
Med.Gloves	827,300
Other Gloves	91,900
Condoms	76,600
Catheters	61,200
Thread	153,200
Balloons, Teats	137,800
Carpet Backing	91,900
Foam	61, 300
Others	30,600

NR LATEX AND PRODUCTS IN THE ASIAN CONTEXT

YEAR 2020	NR LATEX *(MTA)	ASIA LATEX TOTAL (MTA)	% SHARE
CONSUMPTION	1,532,000	1,409,400	92.0

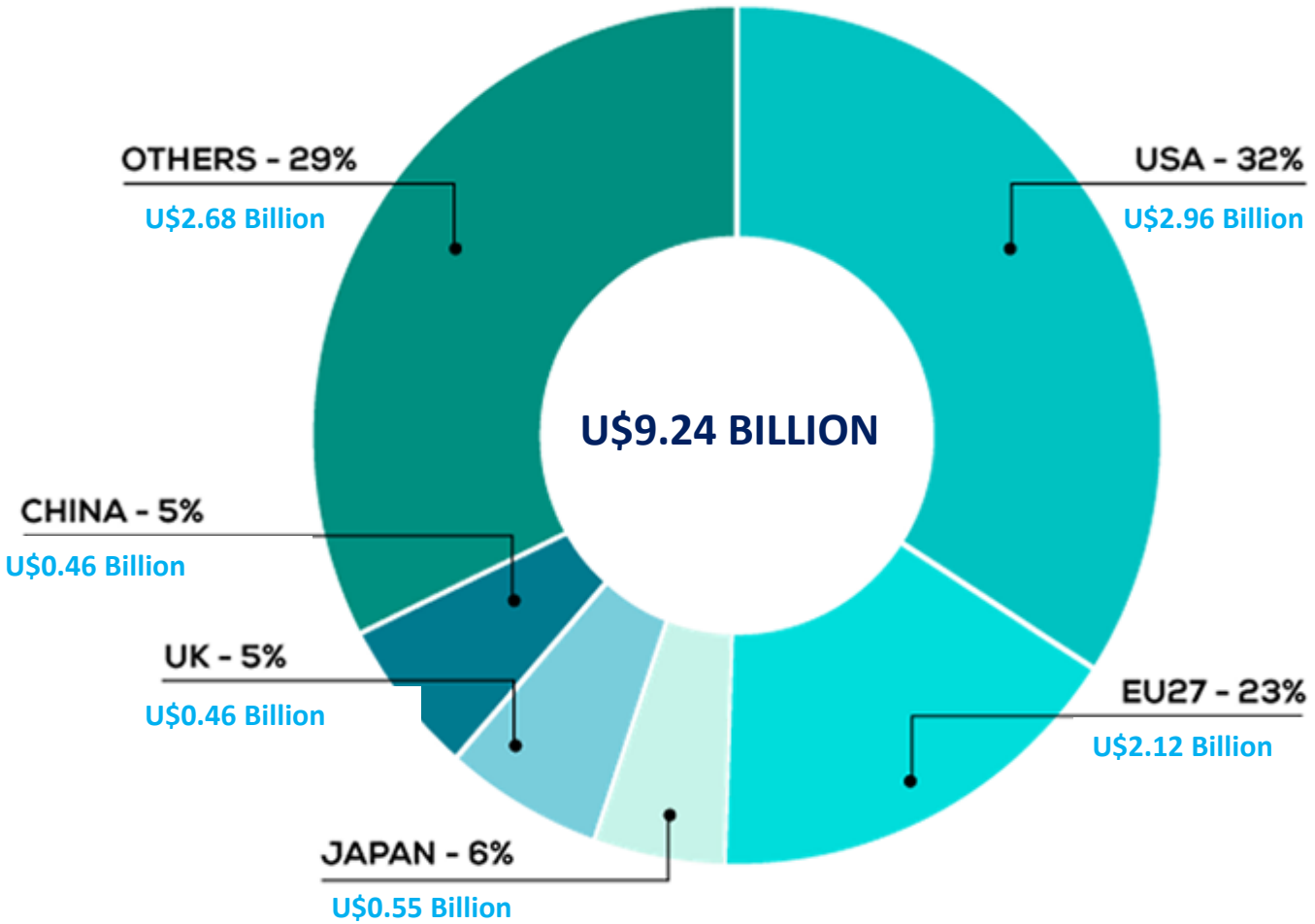


COUNTRY	QUANTITY(MT)
CHINA	444,280
MALAYSIA	413,640
THAILAND	226,736
INDONESIA	114,900
INDIA	76,600
VIETNAM/O ASIA	44,428
SRILANKA	33,704
JPN/SK/TWN	22,980
BRAZIL/MXCO/OA	52,088
EU/EMEA	62,812
USA/CNDA	45,960
TOTAL	**1,532,000**

Source: IRSG Statistics

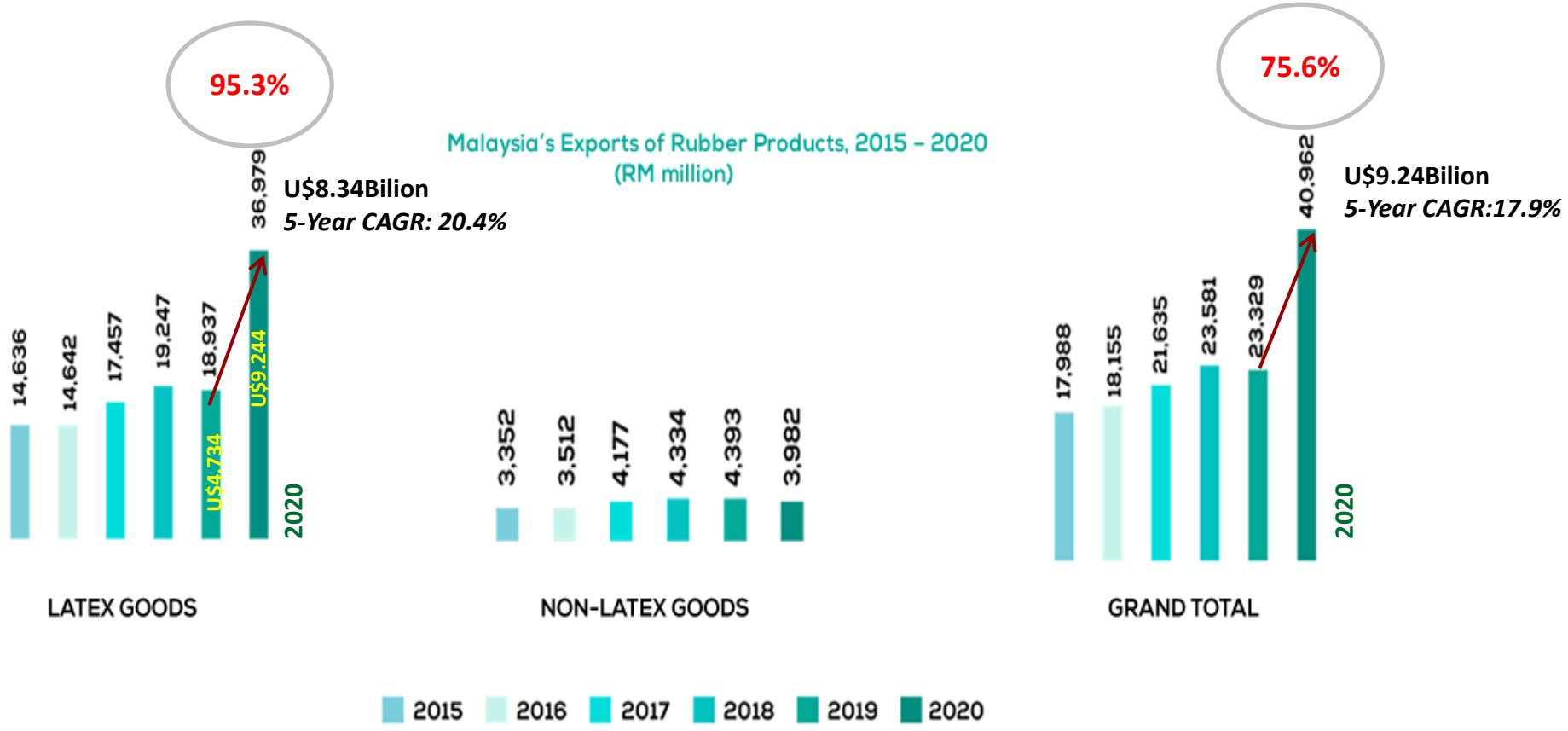
MALAYSIAN LATEX RUBBER PRODUCTS

Exports of Rubber Products by Destination, 2020



Source: Dept of Statistics, Malaysia

MALAYSIAN INDUSTRY EXPORT PERFORMANCE



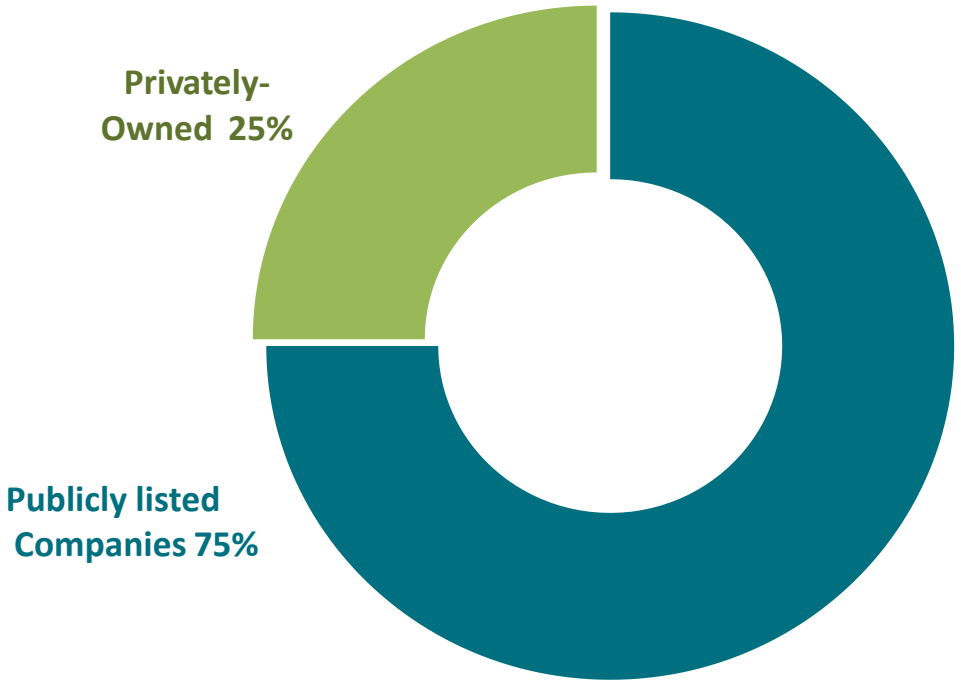
THE DEMAND IMPACT OF THE PANDEMIC IS SEEN FROM THE 2020 GROWTH
THIS MALAYSIAN SURGE COULD SUBSIDE AND BE REDISTRIBUTED IN THE YEARS AHEAD.

Source: Dept of Statistic, Malaysia

MALAYSIAN RUBBER GLOVE PRODUCTION CAPACITY IS RAMPING UP

MALAYSIAN GLOVE OUTPUT IN 2020 - 330 BILLION PIECES UP FROM 220 BILLION PIECES EARLIER

The increase signified that existing dormant capacity was utilised with capacity addition in 2020



Total Factories
127

Installed Production Lines
2,086

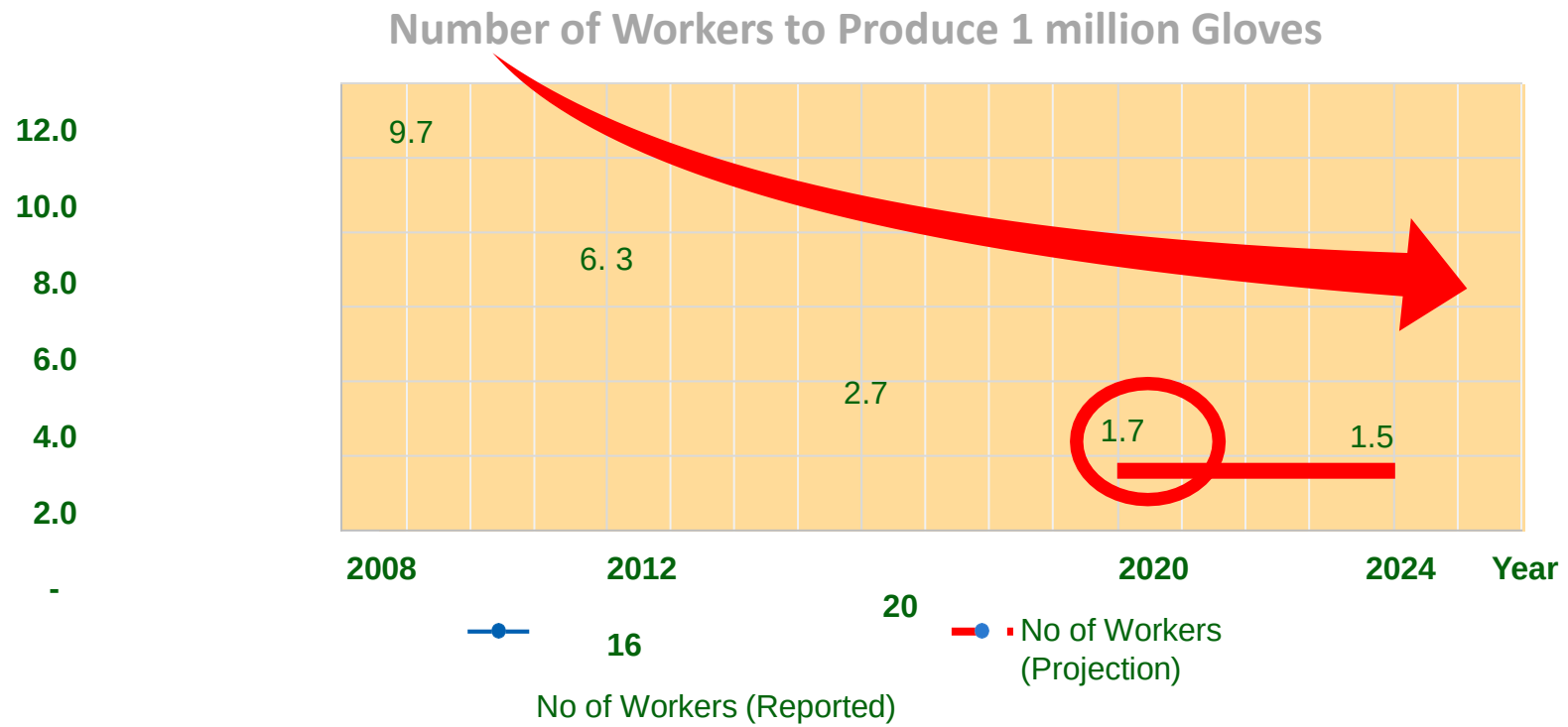
2019 Installed Production Capacity
278 bil

(Utilization rate at 75% and above)

Source: Dr Supramaniam, MARGMA Malaysia

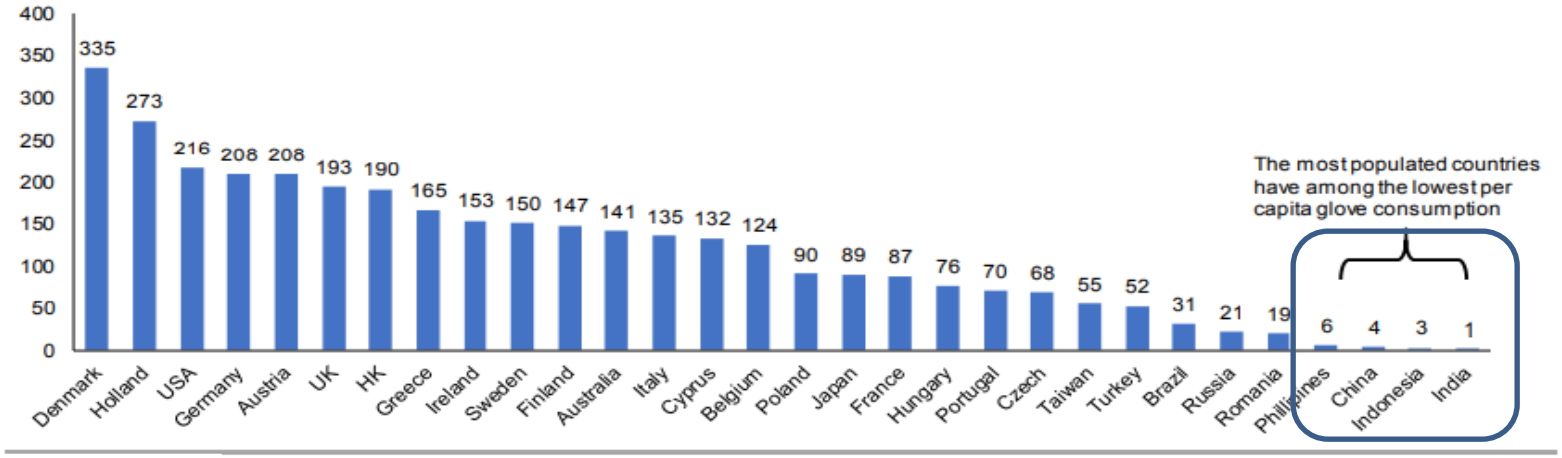
INCREASED PRODUCTIVITY IN GLOVE MANUFACTURING

Modernization and automation lead to leaps in productivity in some of the **more advanced** factories. Further advances in AI and robotics for inspection, testing and packaging are expected.



Source: Malaysian Rubber Glove Manufacturers Association (MARGMA)

GLOBAL GLOVES PERSPECTIVE
PER CAPITA POTENTIAL FOR GROWTH



Country	Per Capita Gloves 2020	Glove Usage (Billion) 2020	Population (Million) 2030	Per Capita Glove (Estimated) 2030	Gloves Usage (Billion) 2030	Increase (Billion) 2030	
China	4	5.776	1,494	**6**	8.964	3.188	
India	1	1.393	1,534	**4**	6.136	4.743	
Indonesia	3	0.828	305	**6**	1.830	1.002	
Philippines	6	0.666	126	**10**	1.260	0.594	
Demand		**8.663**	**3459**		**18.190**	**9.527**	**CAGR 7.7 %**
Global	**42**	**330.0**	**8600**	**60**	**516.00**	**186.00**	**4.6%**

Source:Hartalega KAF

KEY CHALLENGES FACING THE ASIAN LATEX PRODUCTS INDUSTRY

MANPOWER:

- Chronic shortages
- Migrant labour
- Labour and human rights violations

ENERGY :

- Renewable (wind/solar) energy costs still need to be lowered for better efficiencies

LATEX SUPPLY:

- Malaysia (!) and China are importing their excess needs
- Thailand and Indonesia ramping up domestic use
- Nitrile is in tight supply but production is being ramped up in S.Korea and Malaysia

WATER SUPPLY AND DISCHARGE

- Is an increasing challenge for the industry.
- Eliminate chemicals harmful to aquatic life

- **ULPL VYTEX with** lower water leaching requirements (***pre-extracted non rubber solids-NRS***)
- **Vytex PV** has the dual advantage of subliminal ***NRS and removal of nitrosamine residues***.

Source: Dr Supramaniam MARGMA Malaysia

THE ULTRA LOW PROTEIN LATEX AND DEPROTEINISED NATURAL RUBBER PLATFORM

The Vytex process allows for a low additional cost (<U$0.10/kg), purer, higher hydrocarbon content with a lower non-rubber solids base material.

This allows for the further modifications without interference from the NRS.

Corrie MacCOLL offers this as a cost effective base material to consumers, currently from 3 production centres of manufacture and to be expanded to 6 to cater to growing demand.

THE SPECTRUM OF SUSTAINABLE NR DRY GRADES

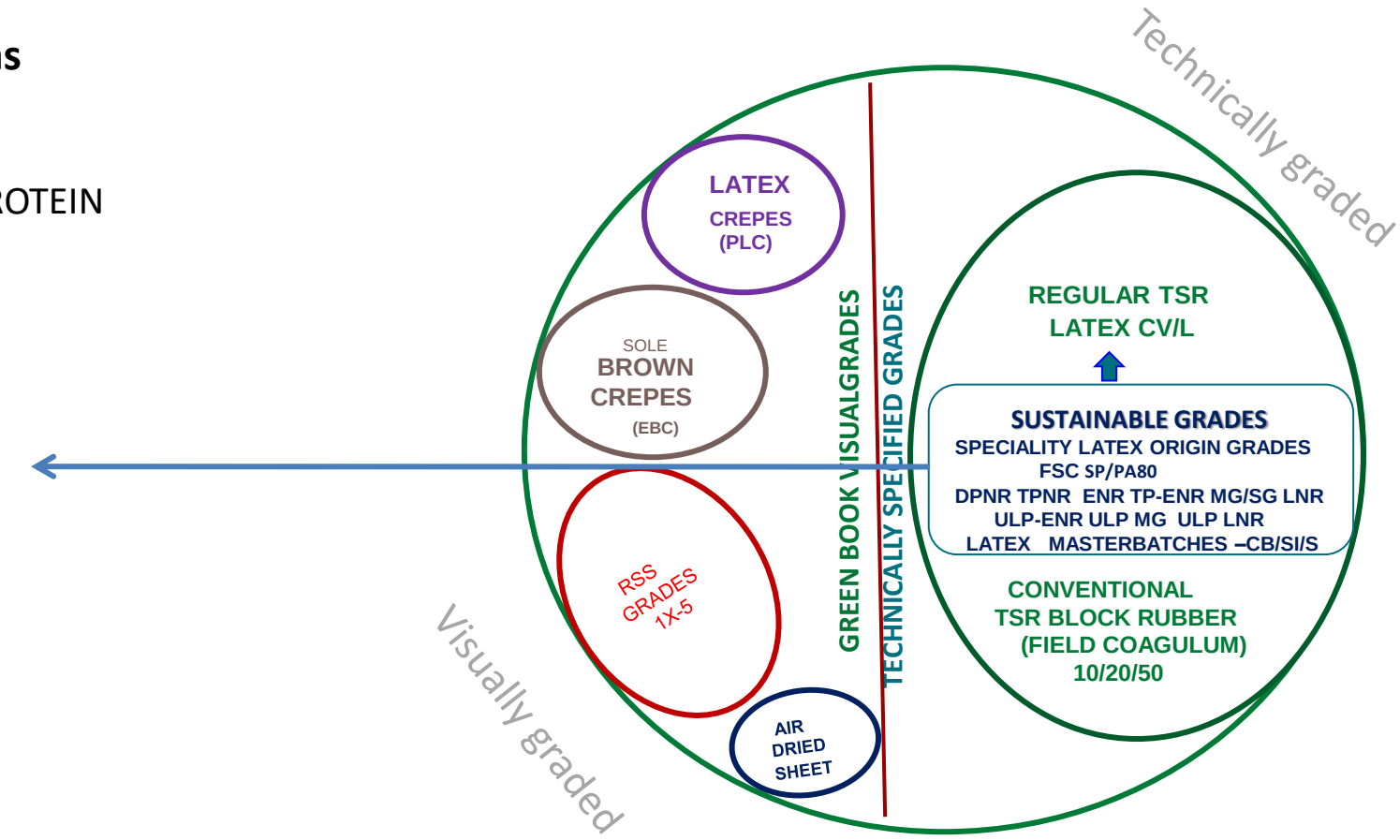
FSC-Ultra Low Protein – Liquid forms

THE BASE PLATFORM – FIELD LATEX

FSC – NITROSAMINE FREE- ULTRALOW PROTEIN

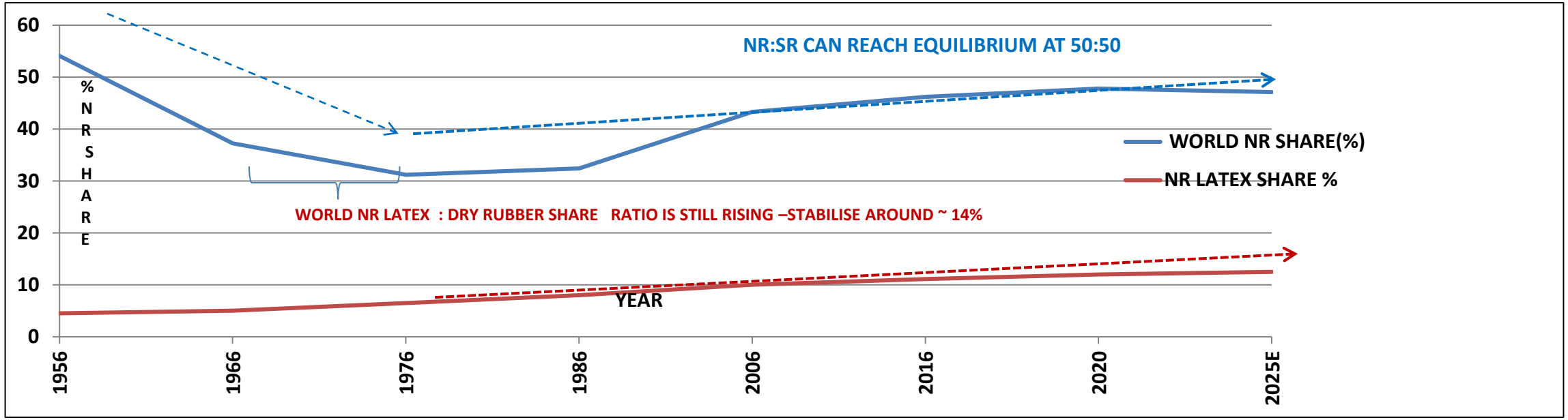
THE SOLID DERIVATIVES:

DPNR
MG RUBBER GRAFT 15/30/50
ENR 10/25/50 (≡ BUTYL/NITRILE)
TPNR (≡ TPO'S)
LIQUID NATURAL RUBBER
HYDROGENATED NR (≡ EPDM)
HALOGENATED NR (CL/BR/I/F)
CYCLISED RESINS AND LOW MOL WT LNR



SUSTAINABLE, ROBUST, COMPETITIVE, UNTAPPED RESERVES WITH POTENTIAL FOR INNOVATION

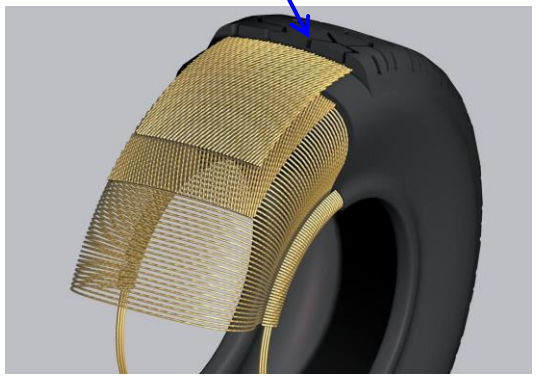
TECHNICAL STANDARDS (SMR/TSR) INTRODUCED (1965-1975) FOR NATURAL RUBBER AND LATEX (ISO/ASTM)



YEAR	1956	1966	1976	1986	1996	2006	2016	2020
% NR	54.1	37.25	31.2	32.4	39.1	43.3	46.2	47.8
+/-		-16.85	-6.0	+1.2	+6.7	+4.2	+2.9	+ 1.6

THE DEPROTEINISED NATURAL RUBBER PLATFORM

Tyre Applications
Low Rolling Resistance and Good and Wet Grip
Technical Data available on request



TYPICAL PROPERTIES OF DPNR	VALUE
Dirt content (%):	0.02
Ash content (%):	0.12
Volatile matter (%):	0.13
Nitrogen content (%):	0.20
Plasticity (P_0):	31.5
Plasticity retention index (PRI):	24
Mooney Viscosity (ML 1+ 4, 100°C):	50-90
Total Protein(µg/g)	<41.5
Antigenic Protein (µg/g)	1.0

ISO Standards being drafted for deproteinised solid rubber and latex

PROPERTIES	APPLICATIONS
Low stress relaxation & low creep	Hydromounts, seals, joint rings, large shock absorbers, suspension bushes and helicopter rotor bearings
Low water absorption	Underwater applications and large shock absorbers
Good dynamic properties	Anti-vibration mountings and surge fenders
Low protein & low ash contents	Medical, pharmaceutical and food applications

DPNR FOOD PACKAGING AND MEDICAL GRADE PURITY AND COMPOSITIONAL ANALYSIS

COMPOSITON ANALYSIS OF DPNR (FOOD/MEDICAL GRADE)	DPNR+ AO	DPNR	DPNR-Latex
HIGH SAFETY FOOD CONTACT DPNR and VYTEX –L	%	%	%
High & low molecular weight cis 1,3 PI (97.18+ 1.38)	**98.56**	**99.06**	**59.50**
Added Food safe AO (FDA approved)	0.50		
Natural fatty Acid Soaps (from the Phospholipid hydrolysis)	0.25	0.26	0.16
Other Non Nitrogenous Organic matter	0.11	0.11	0.07
Metals (P, Zn, Si =0.12, Ca, etc 0.06)	0.18	0.18	0.11
Proteins, Amino Acids and Nitrogenous Bases (Extractable Protein <0.004%)/AP(<0.0002)	0.26	0.26	0.16
Water (VM)	0.13	0.13	40.00
TOTAL	100.00	100.00	100.00

*Extractable Protein by Modified Lowry D5712 <42 µg/g (0.0042%)
*Antigenic protein (ELISA assay) D6499 <1.0µg/g (0.0001%)
Allergenic Bev Proteins (ASTM 7427) [1]

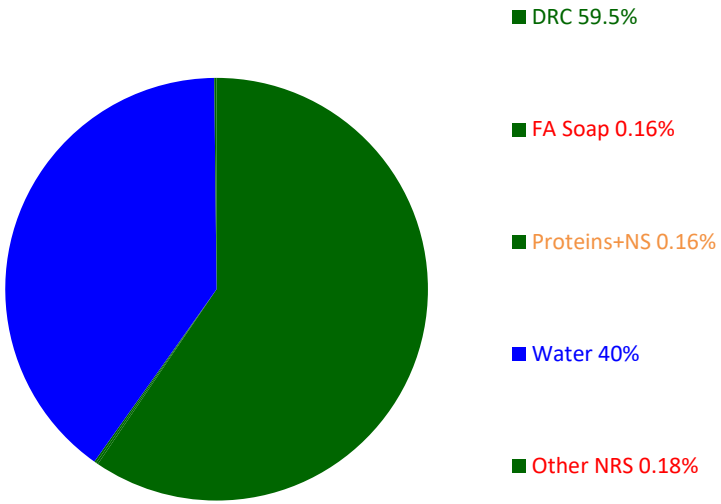
ALLERGENIC PROTEINS		Test	PACIFIER NR	NR-CV	DPNR	DPNR+AO	Detection limit
Hev b1 (ug/ml)) [1]	rubberelongation factor (14.6 kD)	FitKit ®	Below Detection (BD)	BD	BD	BD	2.0 ng/L
Hev b3 (ug/ml)) [1]	rubber-particle protein (24 kD)	FitKit ®	BD	BD	BD	BD	2.0 ng/L
Hev b5 (ug/ml)) [2]	acidic latex protein (16 kD)	FitKit ®	BD	BD	BD	BD	1.5 ng/L
Hev b6 (ug/ml) [2]	Hevein (4.7 kD)	FitKit ®	**9**	**9.8**	BD	BD	1.5 ng/L
Antigenic proteins (ug/ml)		ASTM6499	**0.7**	<0.2	**<0.2**	**<0.2**	0.03 ug/ml

[1] Spina bifida patients [2] Previously found in medical glove extracts

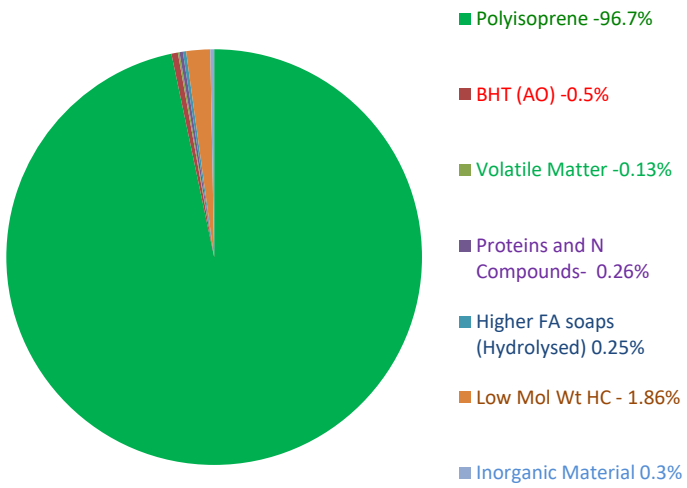
ULP LATEX AND DPNR COMPOSITION

Latex Composition%

Excludes Added Preservatives



Solid DPNR Composition %



COMPOSITIONAL ANALYSIS IRMRA LABORATORIES			
Residues of Additives	**ppm**	**Method**	**Description**
Ammonia	zero	NH3	Evaporates DURING DRYING
DAHP/Phospholipid hydrolysis residues	476 (0.047%)	ICP-MS	Based on phosphorus analysis
$Al(OH)_3$	17.58 (0.00176%)	ICP-MS	Based on AA analysis
Antioxidant	5000(0.5%)	theoretical	AO is not water soluble so it remains in the final NR
Formic Acid	zero		Repeated water rinse. pH neutral

Medical Body and Food Contact Packaging Applications Grade

INNOVATION AND SUSTAINABILITY TRENDS IN SPECIALITY NATURAL RUBBER AND LATEX

- BIOELASTOPLASTIC MATERIALS THROUGH DELIBERATE MODIFICATIONS TO VISCOELASTIC BEHAVIOUR
- NATURALLY OCCURING MODIFICATIONS
- EPOXIDISED RUBBER
- HYDROGENATED RUBBER
- GRAFTED RUBBER

BIOELASTOPLASTIC NATURAL RUBBER
FLEXIBLE TO THERMOPLASTIC RUBBER

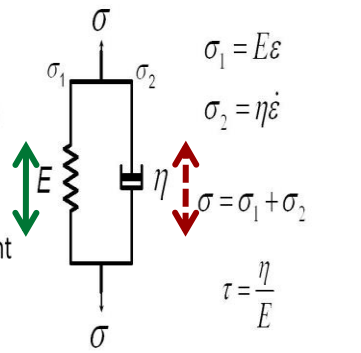
- NR Hydrochlorinated Pliofilms as an alternative to PVC films -PVC is deemed a non sustainable material.
- NR clear films built on an Ultra Low Protein platform now make a comeback.
- TPNR/TPENR (PE OR PP)-Biodegradable Thermoplastic Blocks (e.g.LEGO)

Kelvin Model

Section 3 – Nonlinear Analysis
Module 4 – Viscoelastic Materials
Page 10

- The Kelvin model uses a spring and dashpot in parallel.
- The Kelvin model doesn't match relaxation data.
- It doesn't exhibit time dependent relaxation.

Derivation of Governing Equation



$$\sigma_1 = E\varepsilon$$

$$\sigma_2 = \eta\dot{\varepsilon}$$

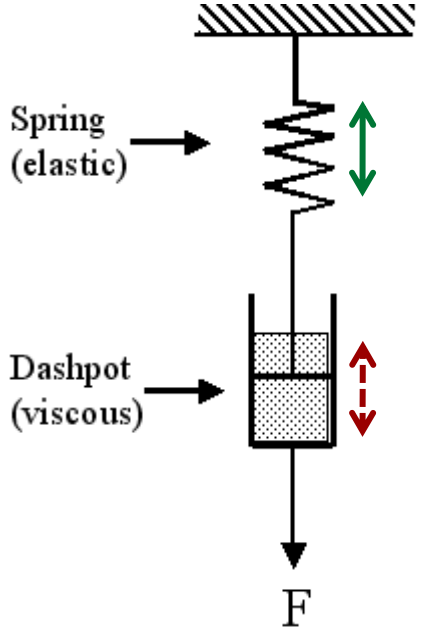
$$\sigma = \sigma_1 + \sigma_2$$

$$\tau = \frac{\eta}{E}$$

$$\dot{\varepsilon} + \frac{1}{\tau}\varepsilon = \frac{\sigma}{\eta}$$

MAIN CHAIN GRAFT OR SIDE CHAIN AND COMPATABILISED PARALLEL CHAIN

Chain Modifications/X-linking/Blends to vary the behaviour of the Spring and Dashpot model (stress relaxation/creep/crystallisation rate



Maxwell Viscoelastic Model

BIOELASTOPLASTIC MATERIALS
BEHAVIOURIAL CHANGE THROUGH THE FOLLOWING PROCESSES

- **DEPROTEINISING OF THE FIELD LATEX**
  WITH DENATURING OF RESIDUAL PROTEINS –**ULTRA LOW PROTEIN**

- **PREPARATION OF ULTRA LOW GEL CONTENT**
  LATICES FROM ULPL LATEX –**ULTRA LOW GEL**

- **EPOXIDATION** OF THE DEPROTEINISED **FIELD LATEX** PRE CONCENTRATION

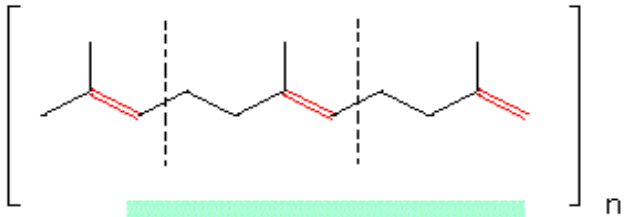
- **DEPOLYMERISED AND HOMOGENISED** DEPROTEINISED LATEX
  FOR UNIFORM PARTICLE SIZE AND MOLECULAR WEIGHT DISTRIBUTION

- **HALOGENATION, HYDROGENATION, CYCLISATION** OF FIELD OR CENTRIFUGED ULPL LATEX

- **CUSTOM GRAFTED LATICES FROM ULPL** WITH VARIOUS
  MONOMERS IN THE RANGE OF 15-50% (MOLAR RATIO)
  MMA, VA, VP, CPLM, XL-TION

- **CUSTOM COMPOUNDED DPNR AND ENR BLOCK RUBBERS**
  WITH CARBON BLACK, SILICA/ENR/SWCNT
  INCORPORATED IN THE POST MODIFIED LATEX STAGE

USING NATURE'S EXAMPLE OF THE MODIFICATION OF CIS/TRANS, VINYL (1,2) ISOMERS WITH INBUILT STEREOSPECIFICITY AND TACTICITY



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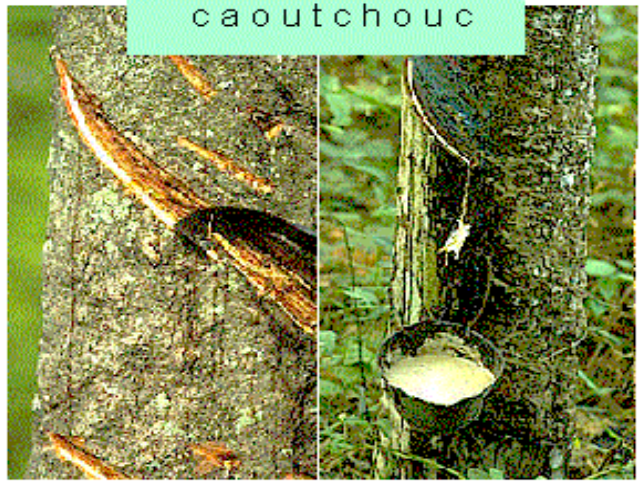
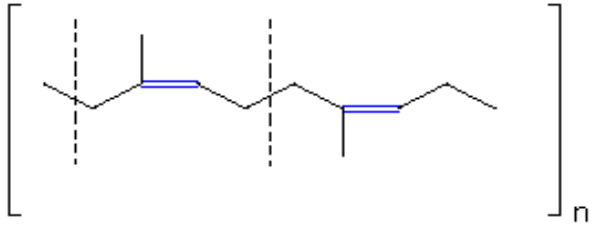
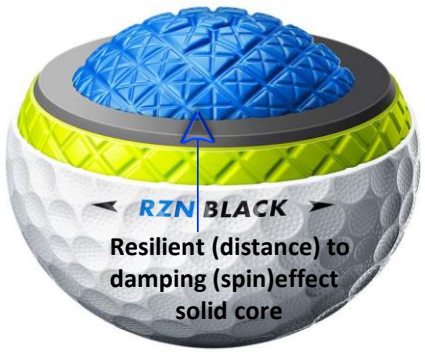




gutta-percha

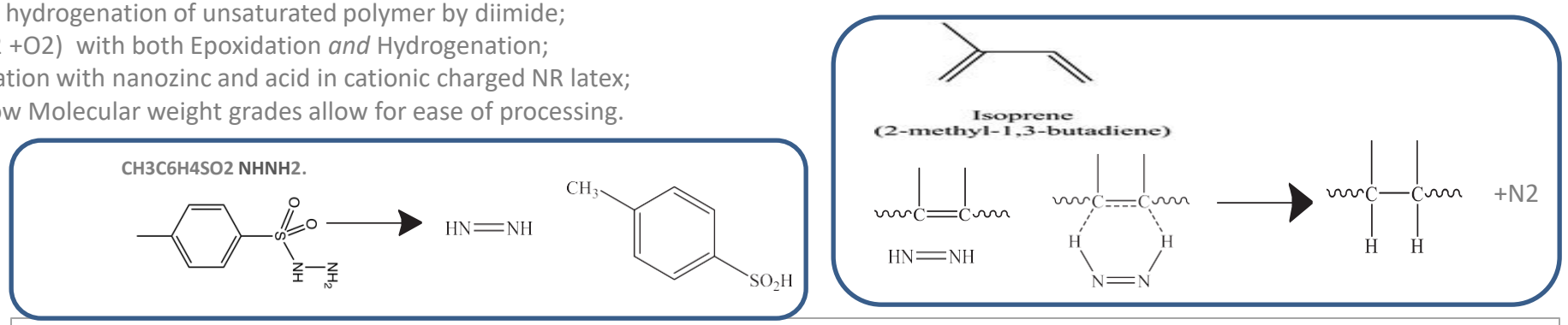
balata - chicle



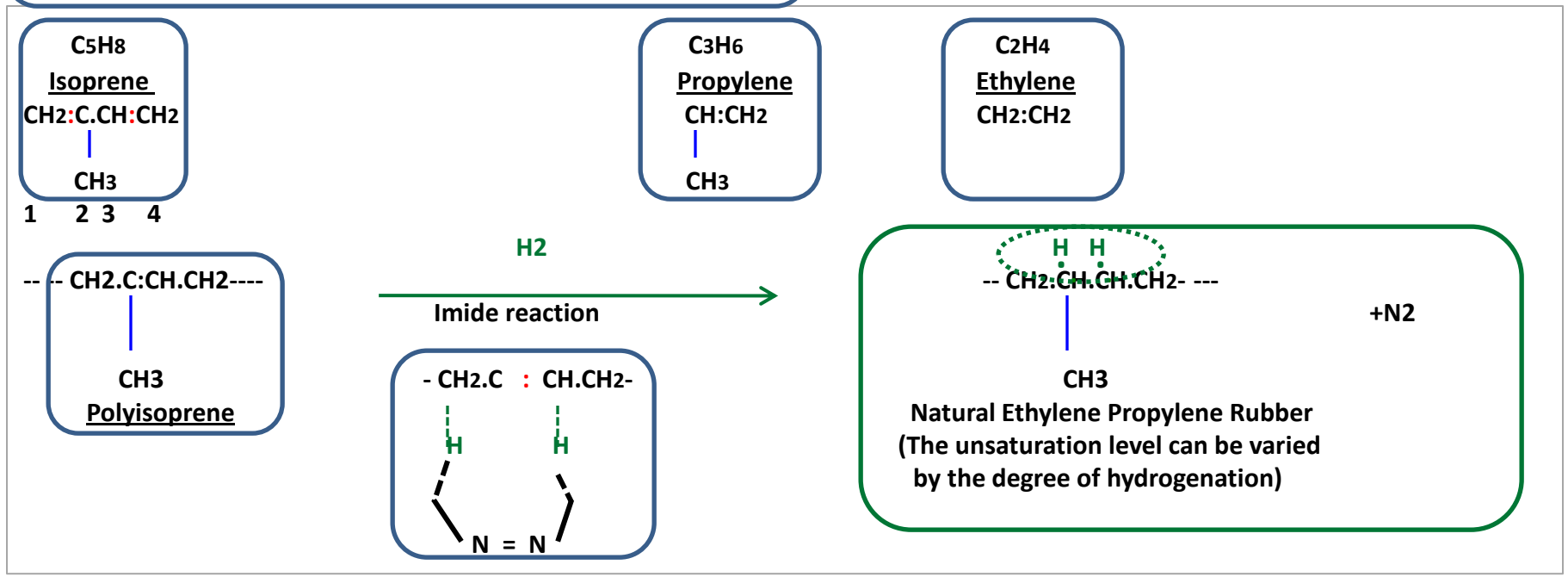
HYDROGENATION OF ULPL AND LNR FOR A NATURAL RUBBER EPDM

Choice of cost effective **hydrogen generation** "*in situ*" is the key. Hydrogen fuelled Vehicles are generating new, cheaper H2 technologies
High, ambient and low temperature options are being evaluated for solid and latex DPNR with IRMRA. Options include :
Thermolysis of TSH and hydrogenation of unsaturated polymer by diimide;
Electrolytic method (H2 +O2) with both Epoxidation *and* Hydrogenation;
Conventional H2 generation with nanozinc and acid in cationic charged NR latex;
Catalytically reduced Low Molecular weight grades allow for ease of processing.

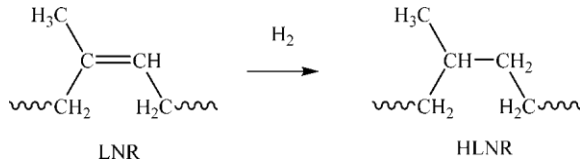
Hydrogen Generation "*in situ*"

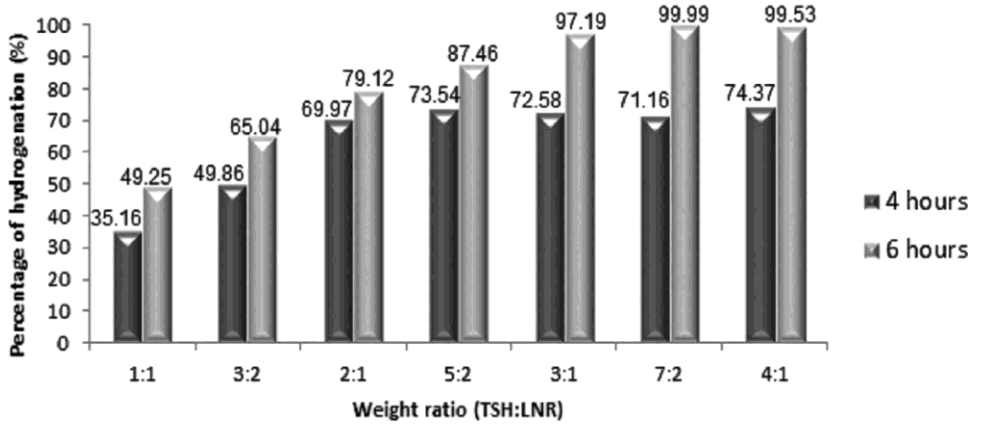


Hydrogenation "*in situ*"



REDUCED MOLECULAR WEIGHT HYDROGENATED NATURAL RUBBER





Decomposition Temperature of Rubber Samples

Rubber	Hydrogenation, %	DecompositIion °C
LNR	—	259 – 377
HLNR	75.9	343 – 447
HLNR	94.3	360 – 458
EPDM[a]	—	470

REF: NAHARULLAH JAMALUDDIN,ET AL, RUBBER CHEMISTRY AND TECHNOLOGY, Vol. 89, No. 2, pp. 227–239 (2016)

COOPERATIONS AND COLLABORATIONS
VYSTAR AND IRMRA –R&D COLLABORATION

THE NEW AVATAR

IRMRI
Indian Rubber Materials Research Institute
भारतीय रबड़ सामग्री अनुसंधान संस्थान

An autonomous Institute Under the DPIIT, Ministry of Commerce & Industry Government of India

Buildings under construction

Tyre Testing, Training, R&D Blocks
Sri City, Andhra Pradesh

IRMRA current operational locations

Rubber Park, Howrah, West Bengal
Lab + MSME Incubation Hub

Joint Programmes
VYSTAR-CMC-IRMRA

- Epoxidation
- Hydrogenation
- New Grafts Vinyl Acetate, Caprolactam
- Compounds For Tyres
- Pilot Multipurpose Dipping Unit
- Testing (Including Tyres)

RUBBER SCIENCE AND TECHNOLOGY TEAM AT BOMBAY

Cooperation MOUs

- ASTM (USA)
- LRCCP (France)
- Vystar Corp. (USA)
- GARC (Chennai)
- Bombay University
- VCA(U.K.)
- SASMIRA (Mumbai)

+Others

3-WAY INNOVATION COLLABORATION
IRMRA - CORRIE MACCOLL -VYSTAR

State of the Art R&D Instrumentation Laboratories at all facilities

IRMRA's French Skid Trailer and Special MERCEDES Drive Vehicle to meet AIS 142 Labellingt requirements at GARC Test Track

New Endurance and High Speed Testing Machine at Sri City Campus, AP

BROADER SUSTAINABILITY CHALLENGES IN NATURAL RUBBER

- BROADER SUSTAINABILITY CHALLENGES IN NR
- CORRIE MACCOLL / HALCYON RESPONSES
- CARBON FOOTPRINT
- FSC CERTIFICATION
- CONCLUDING REMARKS

BROADER SUSTAINABILITY CHALLENGES IN NR

Connect sustainability-driven technological innovations in NRL/NR with the broader impact of the NR sector on wider environmental, social and economic sustainability concerns

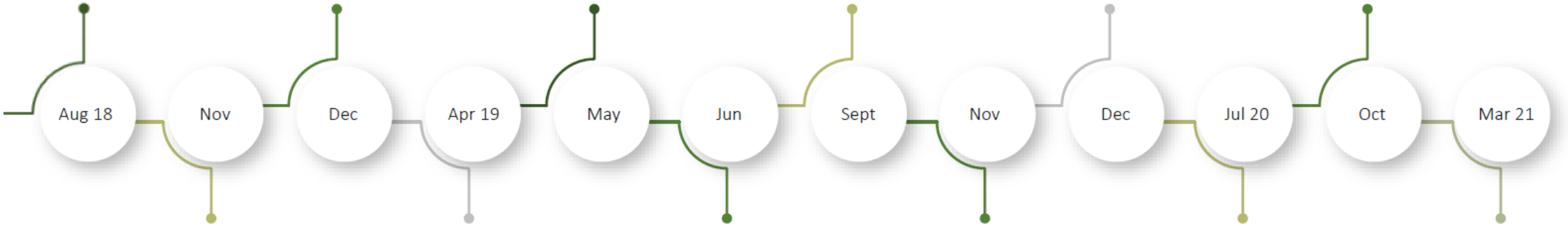
– Key issues :

- Deforestation of HCV tropical land
- Biodiversity
- Carbon impact
- Human & Labour Rights issues
- Low price – impact on smallholder livelihoods
- Biodegradability, recycling and end-of life issues

CORRIE MACCOLL / HALCYON RESPONSES

- Sustainable Natural Supply Chain Policy – developed with Rainforest Alliance and Proforest
- Public zero deforestation commitment – 2018
- Cameroon Outgrower programme launch – 13,000 smallholders educated and financed
- UN Global Compact Signatory – 2019
- Cameroon Initiatives – Corrie MacColl control since 2017
- In-house *HeveaPro* standard across all own processing units
- Sustainable Sourcing Policy (third party supply chain) – developed with Rainforest Alliance
- SSP implementation programme – implementation in co-operation with our processor partners and their upstream supply chain
- IKEA / IOM collaboration on migrant workers in Thailand
- GPSNR
- Forest Stewardship Programme (FSC)

CORRIE MACCOLL & SUSTAINABILITY



WWF's field report

Zero-deforestation commitment in Cameroon

Partnership with **Mighty Earth, CED and APED**

Proforest review **ESIA**

Community programme with **APIFED**

Launched **BOUNCE**, the first rubber sustainability movement anchored by the UN SDGs

Awarded **EcoVadis Gold Medal** for sustainability performance

The **Sustainable Natural Rubber Supply Chain Policy** is launched

The **Cameroon Sustainability Council** is established

Signatory of the **UN Global Compact**

25,000 ha **Community Forest**

Halcyon Agri rated as the **2nd most transparent rubber** company in ZSL's SPOTT analysis

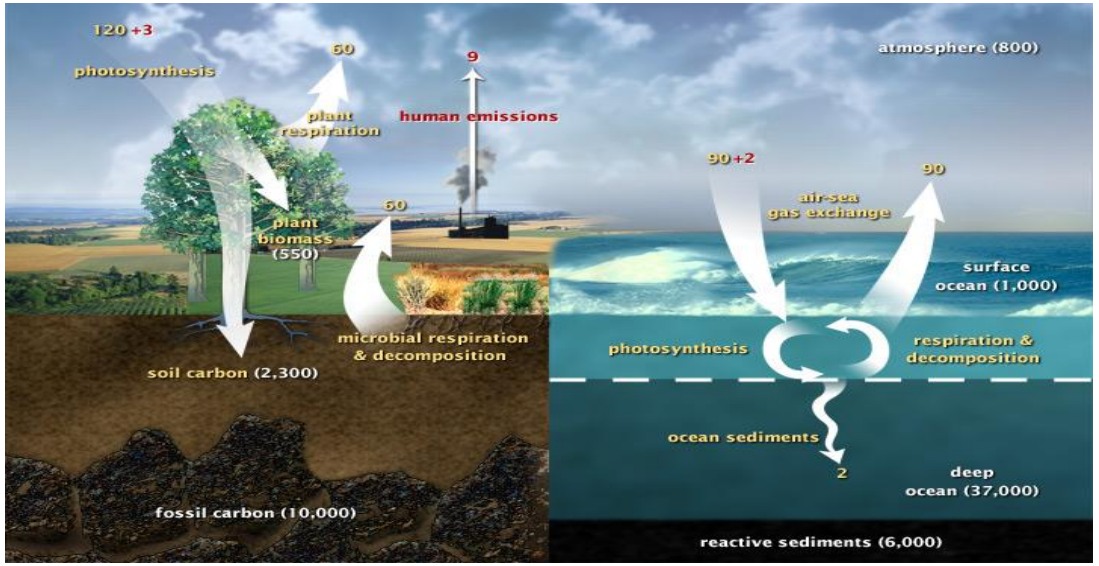
Mighty Earth and PFC join the Cameroon Sustainability Council

Partnership with **Deutsche Bank** on a $25M sustainability loan

Halcyon Agri **rated most transparent** rubber-producing company in **ZSL's SPOTT assessment**

Read more here: https://www.corrie-maccoll.com/sustainabilitymilestones/

CARBON / CLIMATE IMPACT



ISO/IEC 17025:2005-Accredited Testing Laboratory

Summary of Results - % Bio-based Carbon Content
EN 16640:2017 (AMS)

Certificate Number: 439491551794107795
Validation:

Submitter	John Heath
Company	Wufbain
Date Received	January 30, 2020
Date Reported	February 07, 2020
Submitter Label	OUT-2020-006
RESULT: (x_B^{TC})	100 % Bio-based carbon as a fraction of total carbon
Laboratory Number	Beta-551794
Percent modern carbon (pMC)	101.48 +/- 0.23 pMC
Atmospheric adjustment factor (REF)	100.0; = pMC/1.000

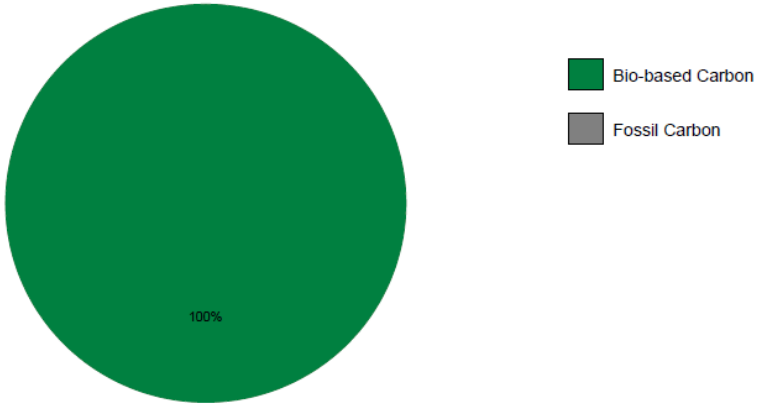
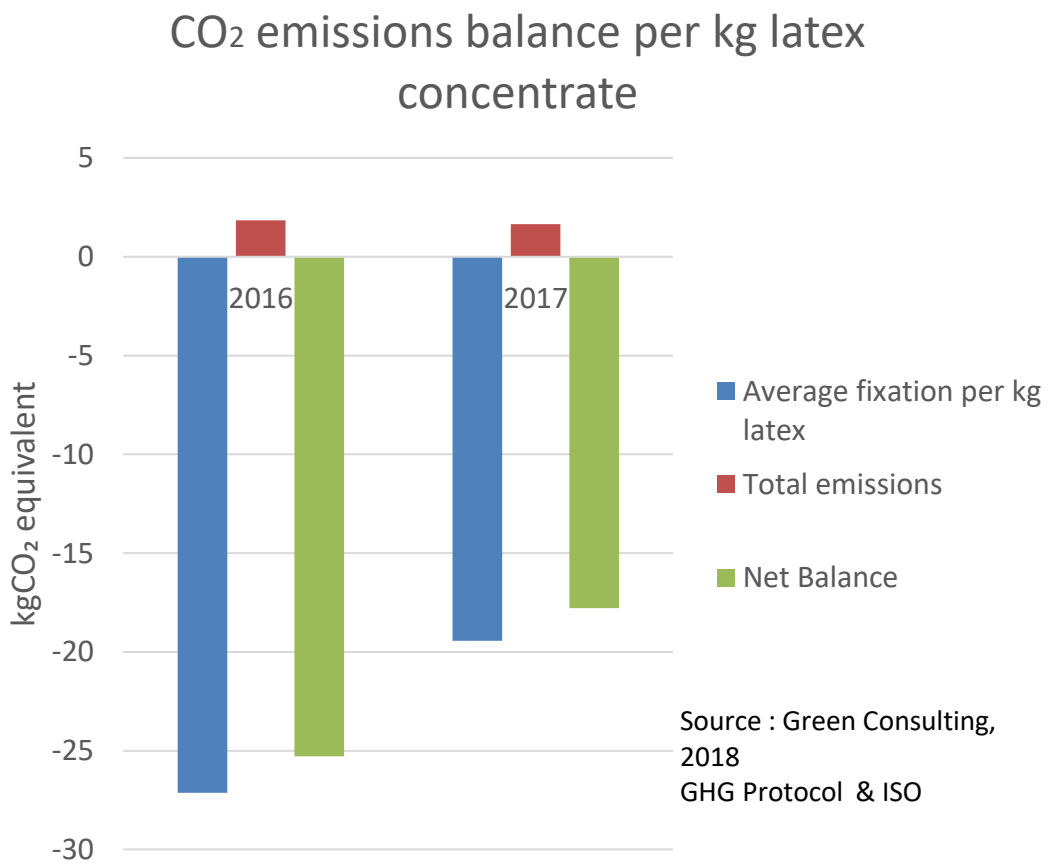


Photo courtesy NASA,USA

CARBON EMISSIONS BALANCE - EXAMPLE

- Emissions calculations are supply chain specific
- In principle, many NR/NRL supply chains can be “net zero” at point of delivery
- Current collaboration with USAID and Thai partners to evaluate one of our Thai supply chains

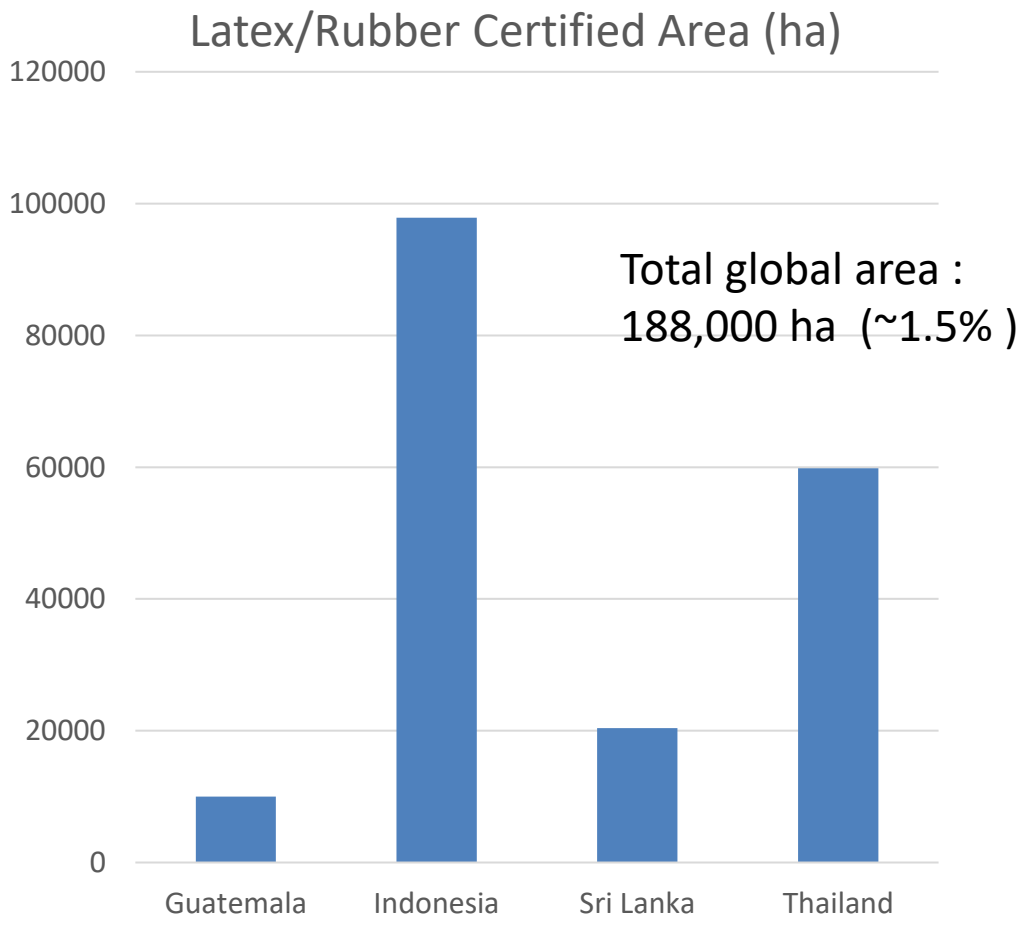


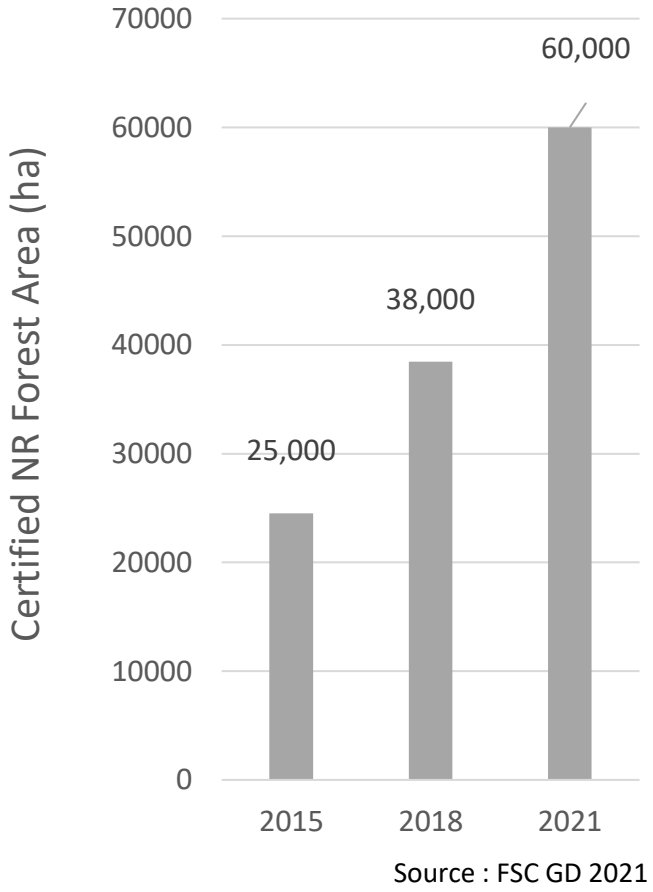
Source : Green Consulting, 2018
GHG Protocol & ISO

FSC CERTIFICATION

- What is FSC?
- Why FSC?
  - “Gold standard” of forestry certification
  - Credible and transparent governance
  - >30 years established in timber/paper sectors
  - Pan-sectoral synergies (e.g. cellulose based textile NTFP)
  - Consumer recognition / FSC brand awareness
  - Independent, accredited verification and certification
  - Best opportunity to generate consumer-driven added value to provide economic incentive to “make sustainability worthwhile” for farmers

FSC IN THAILAND

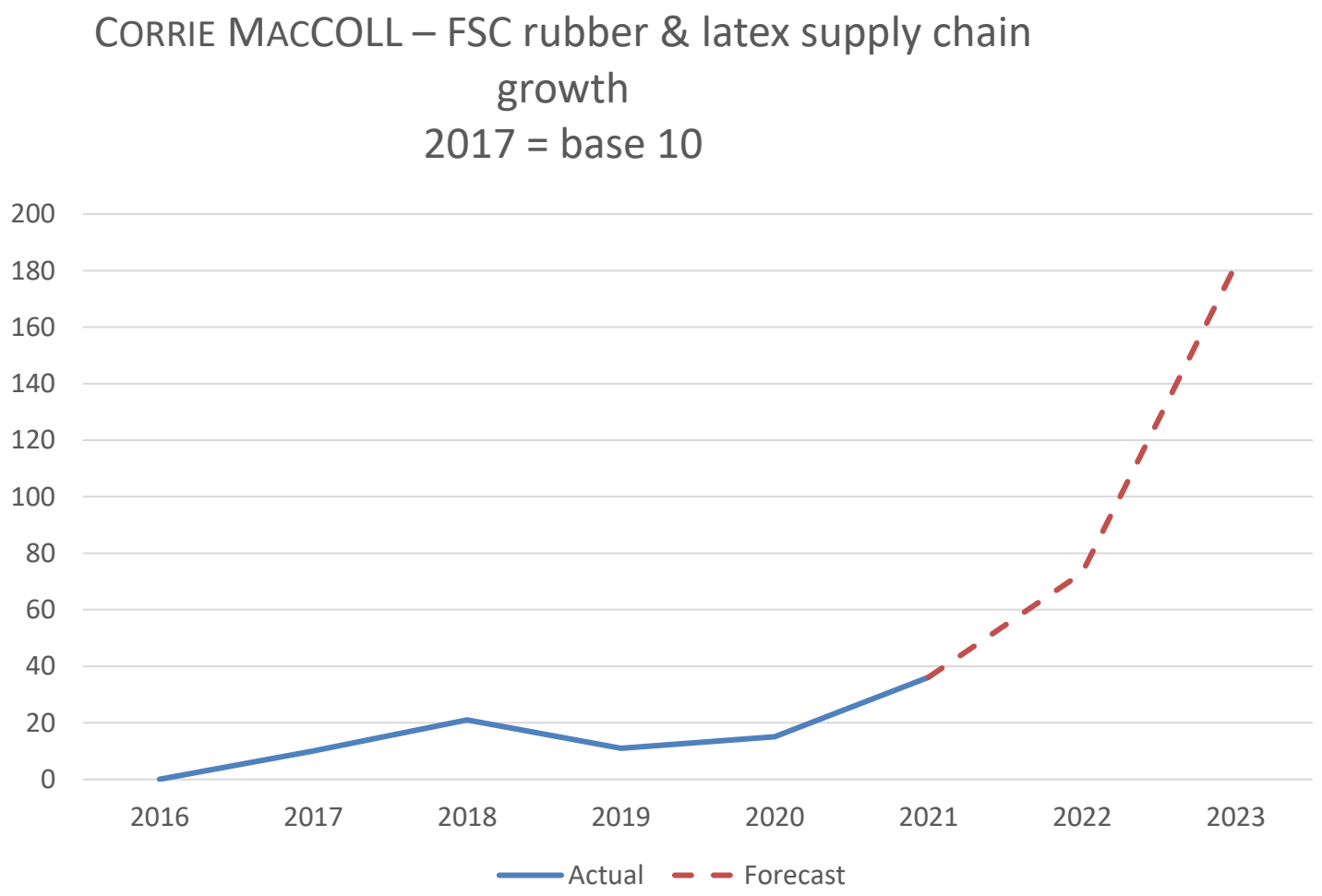




Source : FSC GD 2021

FSC RUBBER SUPPLY GROWTH

- CORRIE MACCOLL expects to surpass 10kt in full year 2021
- Thailand sources now on stream are a game-changer
- Forecast of accelerated growth in 2022-23 is supply chain based
- Slow initial growth was due to limitations on supply
- Now that the smallholder sector in SE Asia has begun to demonstrate that FSC ***is*** achievable, the market growth will be based on the willingness of downstream consumers to convert latent interest to real and continuous demand



3

WORLD'S FIRST FSC-CERTIFIED TIRE

FSC FORESTS FOR ALL FOREVER

PIRELLI

Pirelli P ZERO tyre

BMW

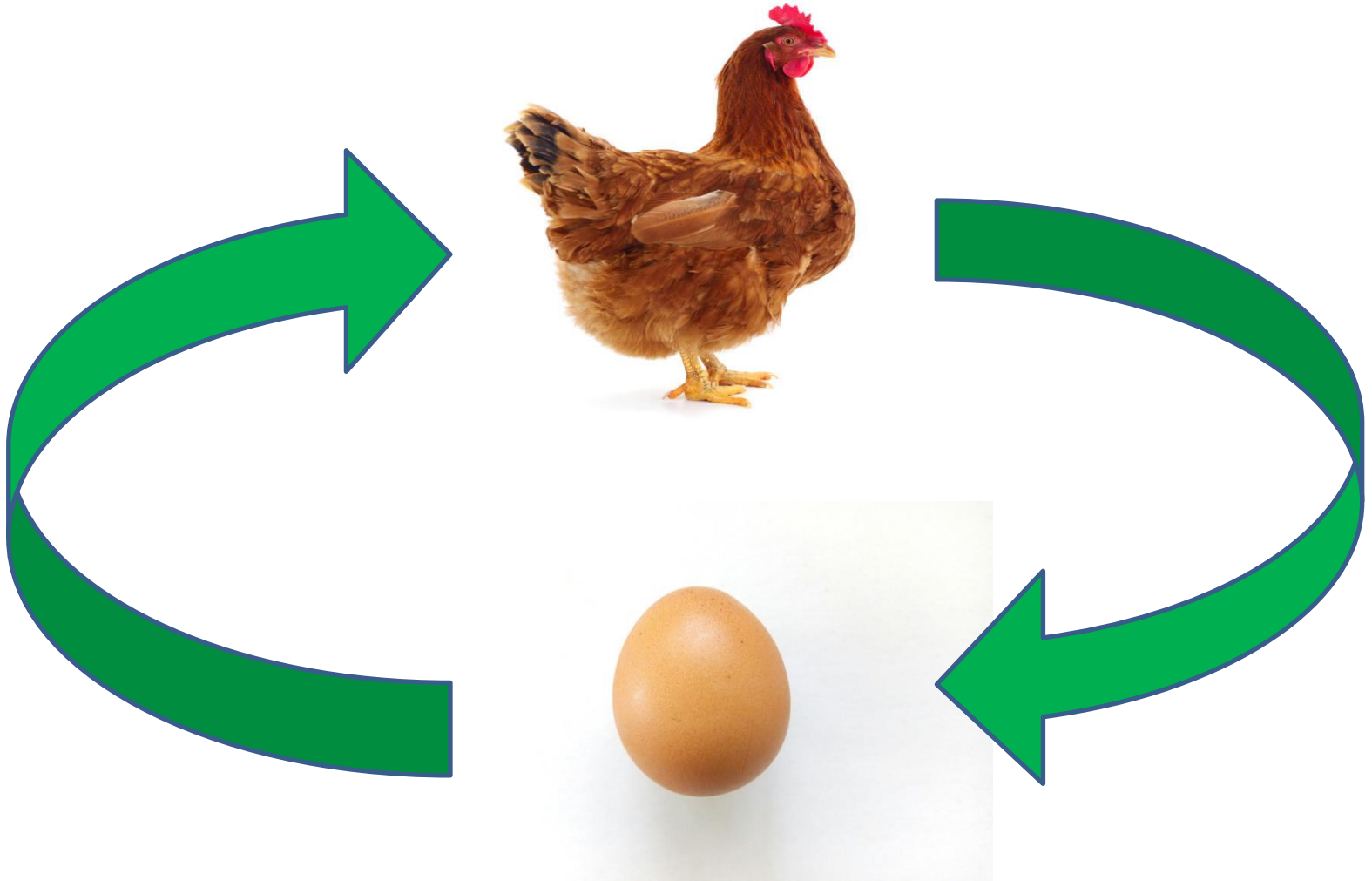
X5 Plug-in Hybrid

FSC-certified
natural rubber and rayon

Press Release

FSC RUBBER – THE CHICKEN AND EGG QUESTION

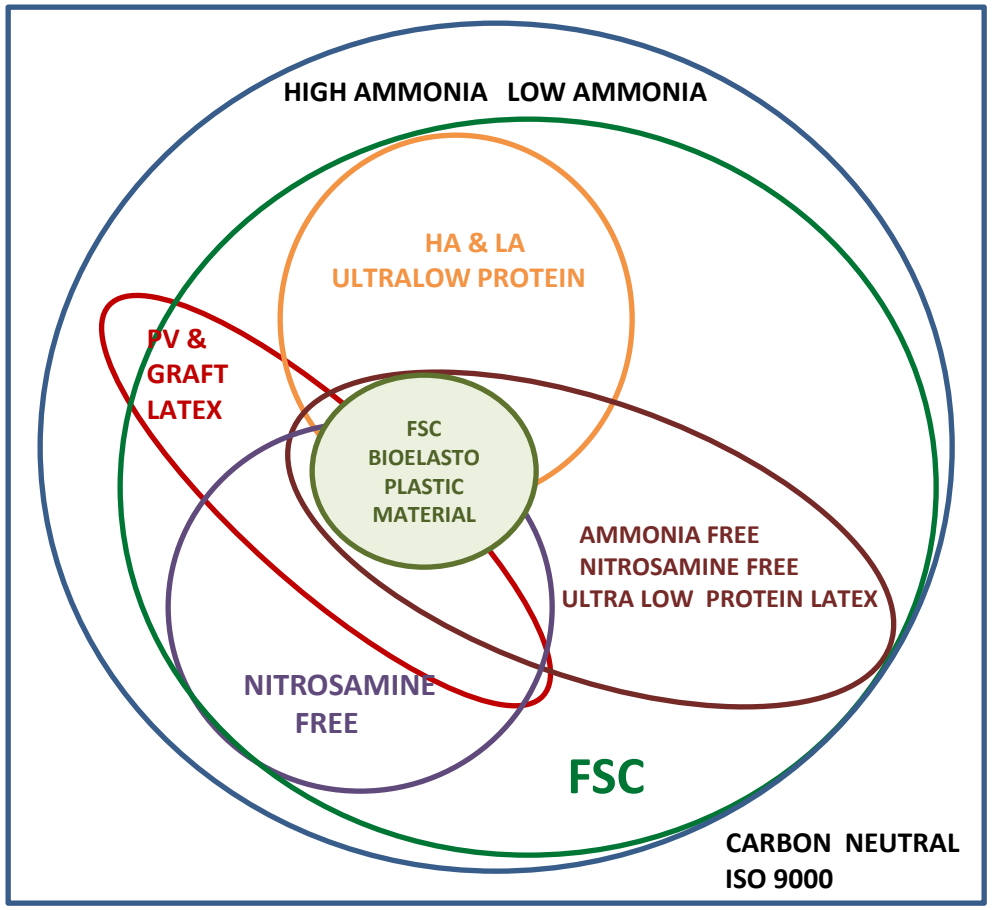
FSC SUPPLY



FSC DEMAND

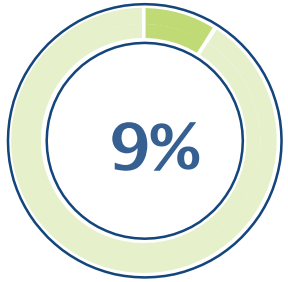
FSC CERTIFICATION

- Concept is to progressively expand the FSC certified natural rubber raw material supply base so that the entire range of new grades based on the Vytex deproteinised latex platform can also be offered as
  - FSC FM/COC certified
  - Carbon Neutral Certified



COOPERATIONS AND COLLABORATIONS
VYSTAR AND CORRIE MACCOLL

HALCYON/CORRIE MACCOLL MARKET SHARE OF NATURAL RUBBER SUPPLIED TO GLOBAL TYRE PRODUCTION



HALCYON/CORRIE MACCOLL GLOBAL NATURAL RUBBER AND LATEX MARKET SHARE

DEVELOPMENT OF VYTEX® DEPROTEINISED LATEX:

Our group-wide innovation capabilities have enabled us to engage in innovative commercial partnerships. **Corrie MacColl is collaborating with Vystar Corporation to transform our Cameroon plantation output into ultra-pure latex with stronger molecular bond that offers enhanced strength, durability and flexibility in the end products.** This is achieved by removing non-rubber components and 99.85% of the proteins

HAC annual report May 2021.

CONCLUDING REMARKS

From a Vytex latex platform we can produce

not only liquid latex concentrate with

- Ultra low protein content
- Reduced NRS
- Safe/compliant preservation systems (TMTD/nitrosamine-free)
- Ammonia-free (if required)
- Pre-vulcanised (if required)
- Grafted (if required)

but also dry rubber speciality grades

- DPNR based and compatibilized to compete with solution SBR in low rolling resistance / high wet grip tyre formulations
- A natural rubber equivalent to EPDM
- A range of other grades with bioelastoplastic properties

…….. all based on a 100% natural entirely biogenic rubber polymer, and increasingly with a fully traceable FSC certified supply chain.

SPECIALITY NATURAL RUBBER AND LATICES

CLIMATE CHANGE SUSTAINABILITY
THE NATURAL RUBBER LATEX MANTRA

4000+ RUBBER PRODUCTS

BE SUSTAINABLE – GO FOR 100% NATURAL RUBBER

A MATERIAL OF THE PAST AND THROUGH INNOVATION THE SUSTAINABLE MATERIAL OF THE FUTURE

Email ID : rkmatthan@gmail