

Plastics & The Sustainability Paradox



Indian Centre for Plastics in the Environment (ICPE)

24th, April 2024

Earth Day – The Genesis



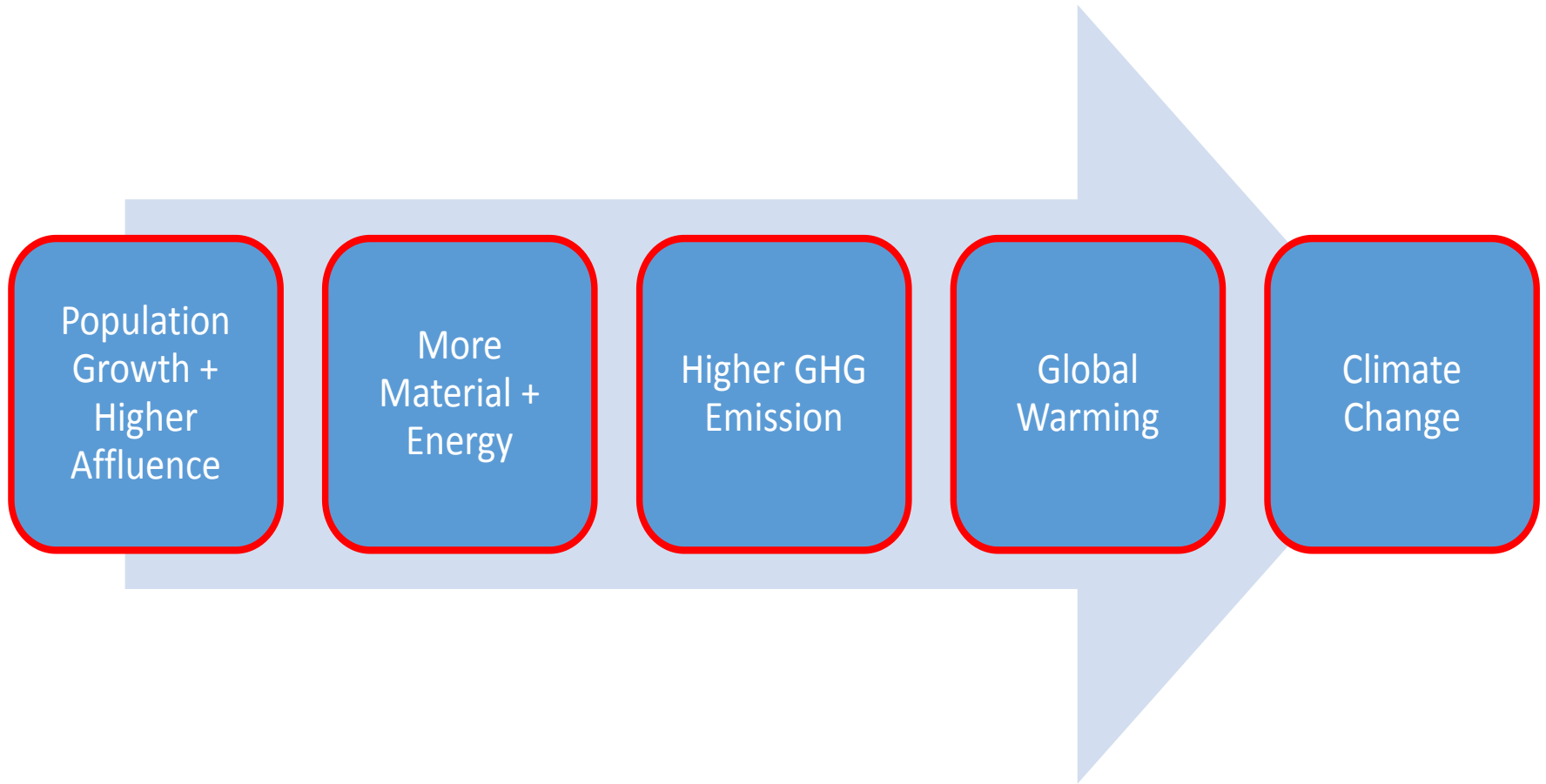
- Launched by American Senator Gaylord Nelson on 22nd, April 1970
- With support from maverick activist, Denis Hayes
- Beginning of a new era that catapulted environmental consciousness to the forefront.
- Theme for 2024: Planet vs. Plastics
- Target 60% reduction in all plastic production by 2040
- Building a plastic free planet for future generation.



Climate Change – The Backdrop

- Long-term average of mainly temperature & precipitation.
- Natural factors:
 - Insolation influenced by location on earth, axis tilt and orbital shift.
 - Geological events like volcanic eruption.
- Human Induced:
 - Deforestation
 - Build-up of GHGs

Climate Change - Pathway



A critical challenge faced by humanity & other living beings

Sustainability



Sustainable Lifestyle

Sustainable Building

Sustainable Cities

Sustainable Fashion

Sustainable Agriculture

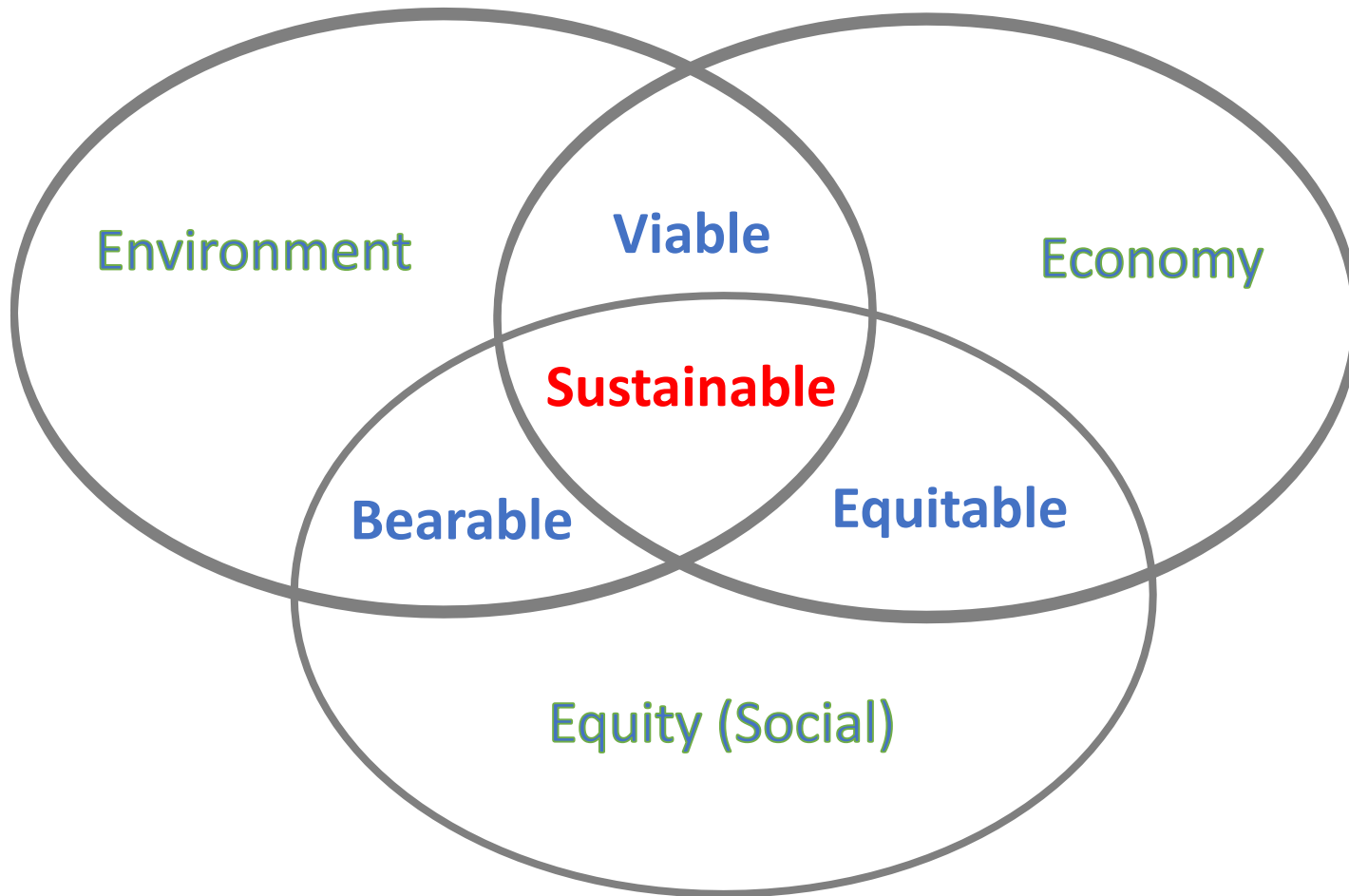
Sustainable Food

Sustainable Packaging

Sustainable Clothing

A buzz word !!!

Sustainability – Classical



Three dimensional interdependent systems

Plastics - Properties



Insulation properties

Thermal Insulation

Electrical Insulation



Barrier properties (O₂, WV)

Lightweight

(1/3rd, Al & 1/8th, Steel)



Durability

Water / Moisture resistant

Corrosion resistant



Safe & Hygienic



Used for their versatility and affordability

Plastics – Uses Spectrum



Agriculture
Production &
Distribution



Consumer
Goods
Packaging



Building &
Construction



Industrial &
Electronics



Plastics

Medical &
Healthcare



Automobile &
Transportation



Plastics & Sustainability



Plastics in Food Sector



- Globally $\sim 1/3^{\text{rd}}$, of food grown is wasted / lost.
- About 800 million people do not have access to adequate food and ~ 300 experience acute hunger.
- Plastic products in modern agricultural increases productivity and reduces losses.
- Use of water + nutrients can be reduced by 50% -70%
- Shelf life of fresh food can be extended by a factors of 2.5 to 10 times
- Shelf life of processed food increased by months – substantial gain over food losses.



Plastics help realize SDG # 2 – Zero Hunger

Plastics in Healthcare

- Modern healthcare sector critically depends on plastics due to their safety and biocompatibility.
- Postnatal delivery of drugs, vaccines and critical care devices use plastic products.
- Plastic products are used in healthcare to provide protection to both recipients as well as the service providers.
- Covid-19 pandemic has underscored the criticality of plastics in facing such crises.



Plastics help realize SDG #3 – Good Health & Wellbeing

Plastics for human habitat

- Plastic are extensively used for building and construction.
- PE & PVC pipes reduces energy use for transportation and delivery of agricultural and potable waters.
- Water distribution in rural and urban locations use plastic pipes for potable water and SWR application
- Wire & Cables use PVC and PE for insulation.



Plastics help realizes SDG #6 & #11



Plastics & Climate Action



- Climate change has reached crisis level.
- COP26 hints at our inability to limit global temperature rise within 1.5°C
- Release of GHGs are implicated.
- Energy production from fossil fuel, key driver of global warming.
- Improving energy efficiency, enhancing renewable energy production and expanding CO₂ sequestration are necessary to mitigate the crisis.
- Solar and wind energy power plants need plastics parts.
- NCS (natural climate solution – green cover) critical for CO₂ sequestration and biodiversity restoration.



Plastics, critical inputs for Climate Action SDG #13



SUSTAINABLE DEVELOPMENT GOALS

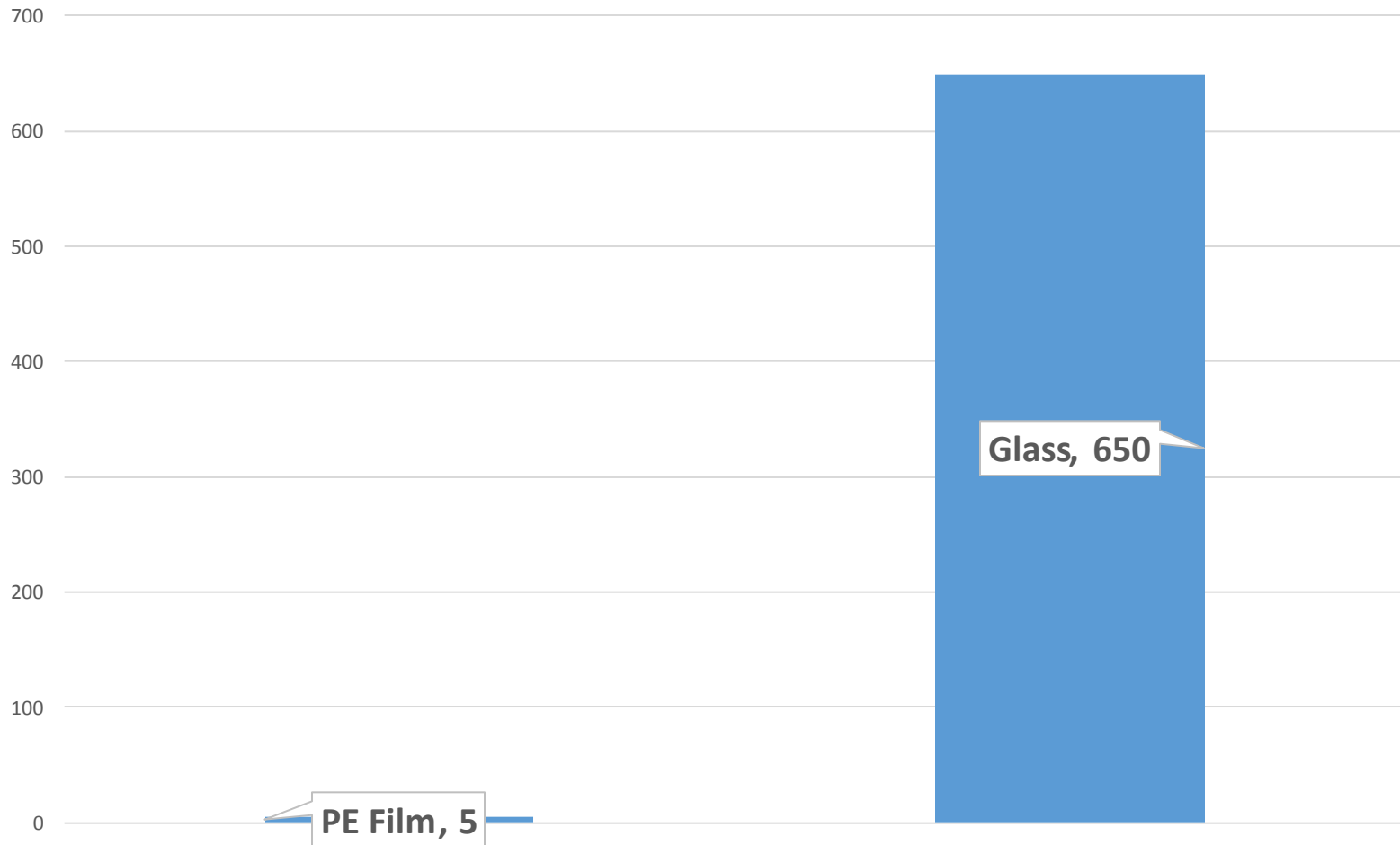


Plastics contribute in 8/17 of SDGs

Plastics in Packaging – Case Study

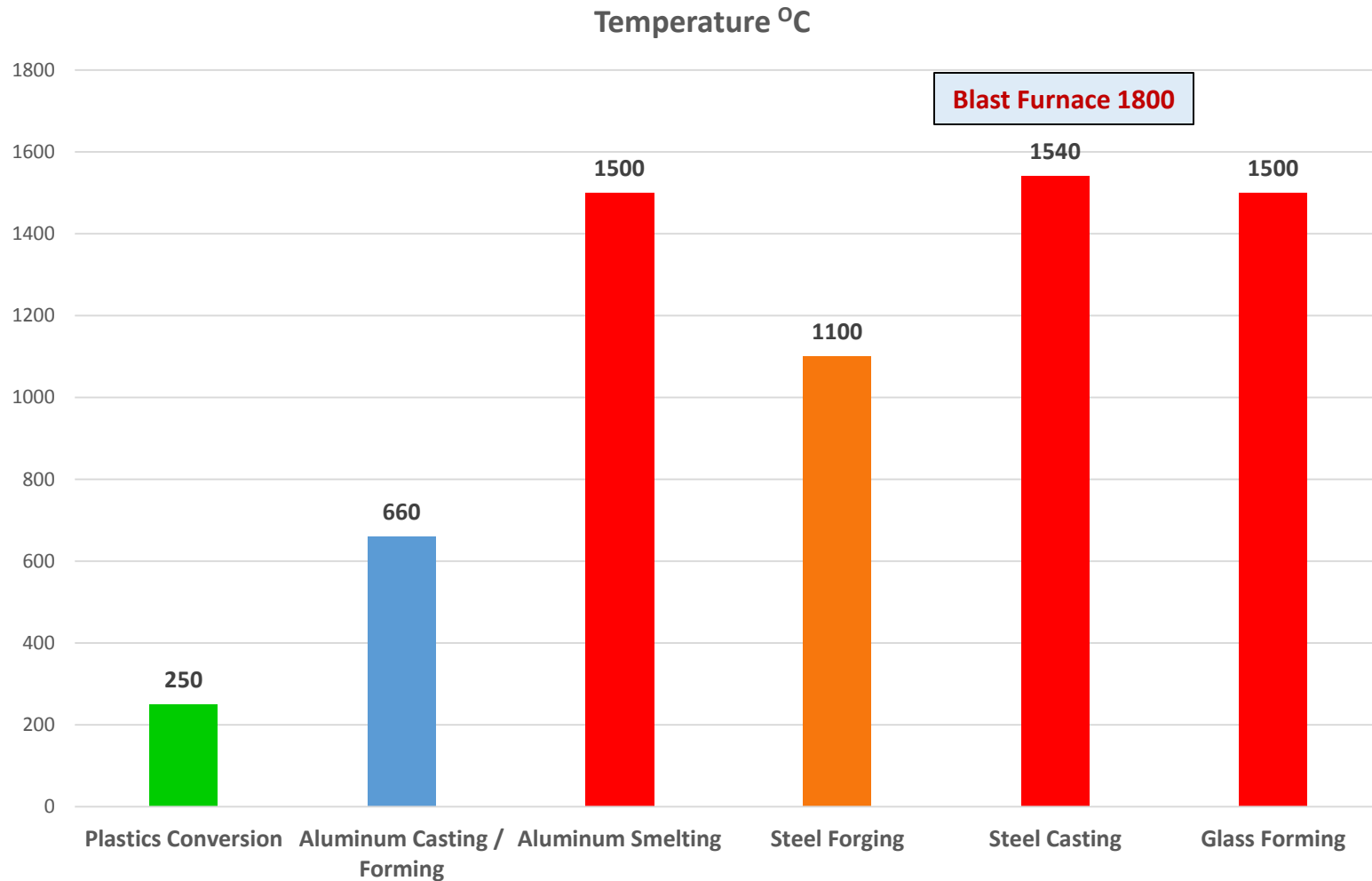


Packing 1 litre of milk (gms)



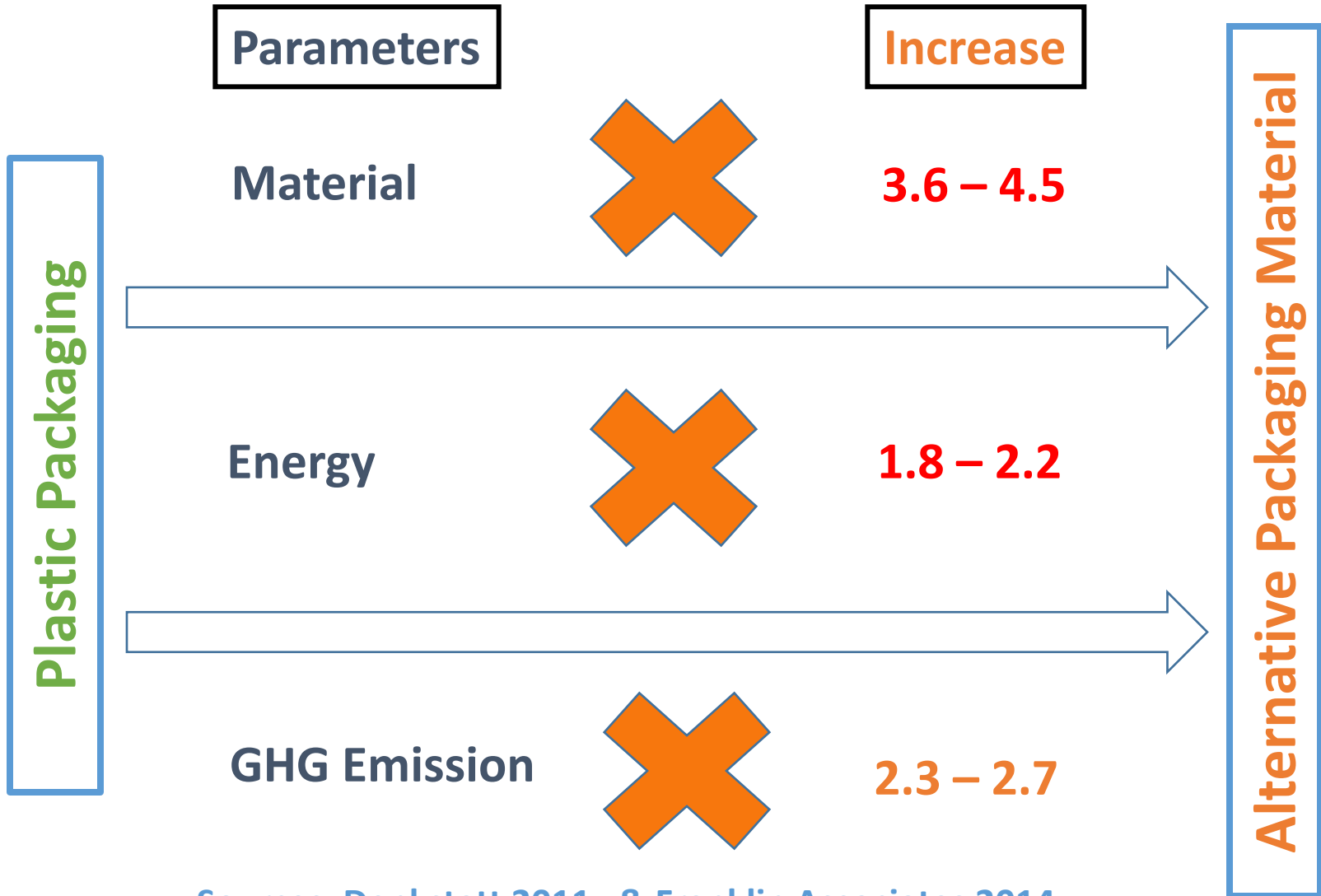
Source: GCMMF(Amul)

Energy Footprints



Over their lifecycles, plastics would be greenest in most products

Packaging – Environmental Impact



Sources: Denkstatt 2011 & Franklin Associates 2014

Plastics in Climate Change mitigation



- With significantly lower densities and greater design flexibilities plastic products are substantially lighter with better functionality.
- This reduces energy demand during service and substantial reduction in GHG emissions despite the fact that over 90% of plastic materials are derived from fossil fuels.
- Conversion and recycling of plastics products are carried out at much lower temperatures (**by factors of 6-7**) thus needing less energy over the life cycle of the product.
- Mitigates pressure on forest resources thereby preserving natural CO₂ sink.

Alternatives to Plastics



- Paper bags lead to deforestation, higher water & chemical footprints, lower performance.
- Cotton puts pressure on agricultural land, has high water and pesticide use, low functionally.
- Glass bottles - higher material, water and energy footprints, also largely fragile.
- Metals - high material and energy footprints, low flexibility.

Single-use plastic bag has lowest environmental footprint compared to paper, cotton or biodegradable plastics. Single-use is more problematic and not plastics ... UNEP

Micro and nano-plastics



- **Microplastics** – synthetic material particles of < 5mm size
- **Nano-plastics** – synthetic material particles in nano scale.
- **Includes** microfibers, micro particles of rubber, cellulosic particles
- **Categories:**
 - Primary** (intentionally added in cosmetic products / leakage from manufacturing plants or during handling)
 - Secondary** (microfibers from washing of clothes, fragmented fishing gears, small fragmented plastic articles).
- **Concerns :** Ubiquitous on land, air, ocean, lakes and living beings.
- **Potential health risk** as a pollutant and possible

Challenges – Solid Waste Pollution



- Globally ~ 2 billion tons / year solid waste is generated.
- Not all solid waste are biodegradable (construction debris)
- > 1/3rd, of MSW not managed scientifically.
- Plastic waste ~ 8-10% of solid waste.
- Bulk of waste generated is incinerated to recover energy or dumped / sent to landfills, eventually leaking into the environment.
- Plastic Pollution, like other solid waste pollution, is a reality needing urgent actions on building infrastructure and promoting behavioral changes (anti-littering, bin culture).
- Transition to circular economy, is the way forward to address plastic pollution.

Waste to Wealth



Plastic Waste

**Well sorted
waste**



Mechanical
Recycling

Same / Similar
Products

**Less sorted
Waste**



Chemical /
Feedstock
Recycling

Monomers /
Building Blocks

**Least sorted
Waste**



Energy /
Material
Recovery

Cement Kilns /
Roads / Power

Recycling – The Holy Grail



PET Bottles



Milk Pouches



Plastic Woven Sacks



Battery Cases



Plastic Carry Bags



PVC Pipes



Apparels



Barsati Film



Niwar patti



Luggage



Mats



Shoes



IPL Indian team



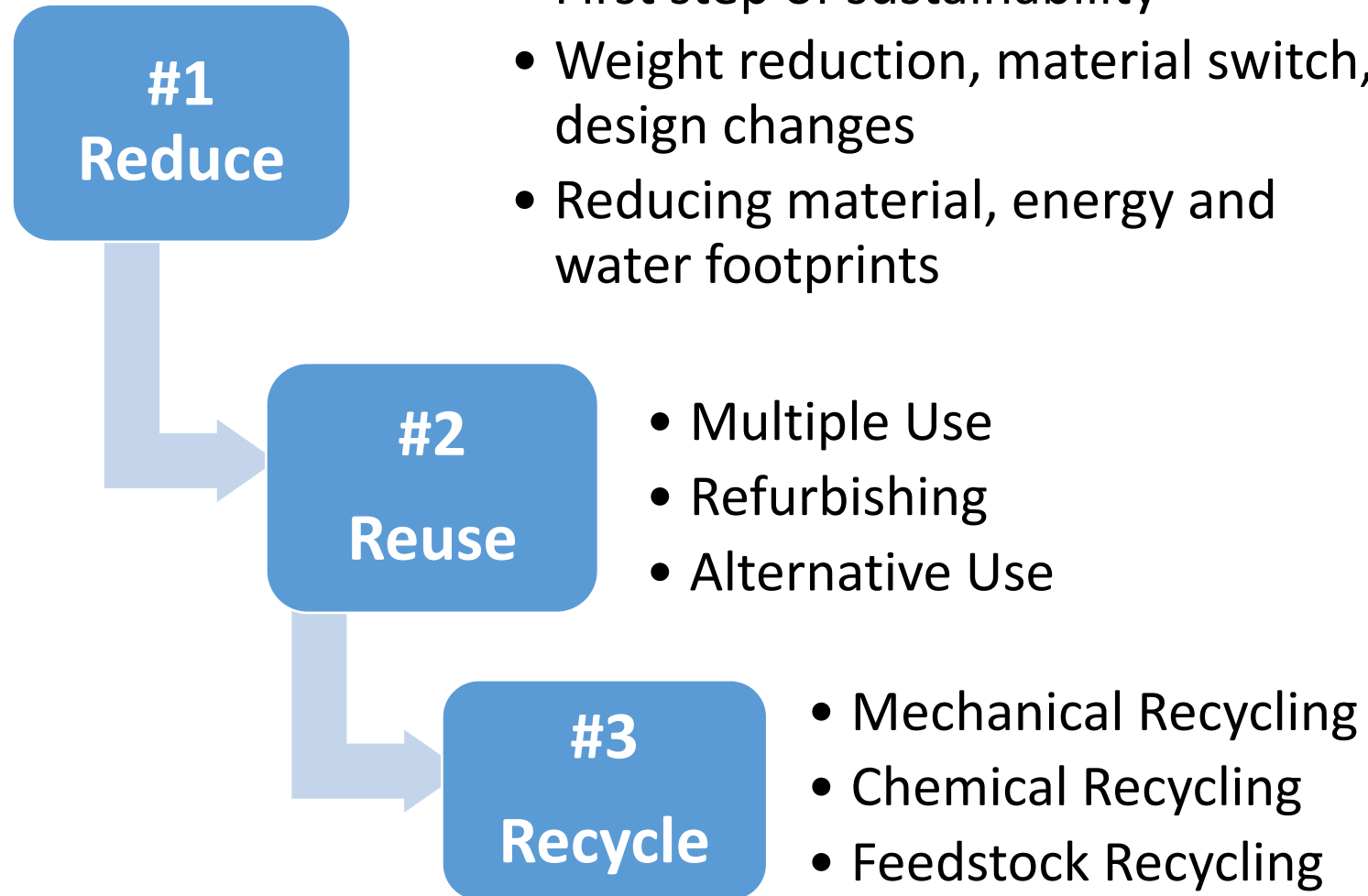
World Cup jerseys
from PET recycled fiber

Illustrative – Non Exhaustive

Epilogue



3 Rs of Sustainability



Hierarchy to reduce environmental impact

Thank You

