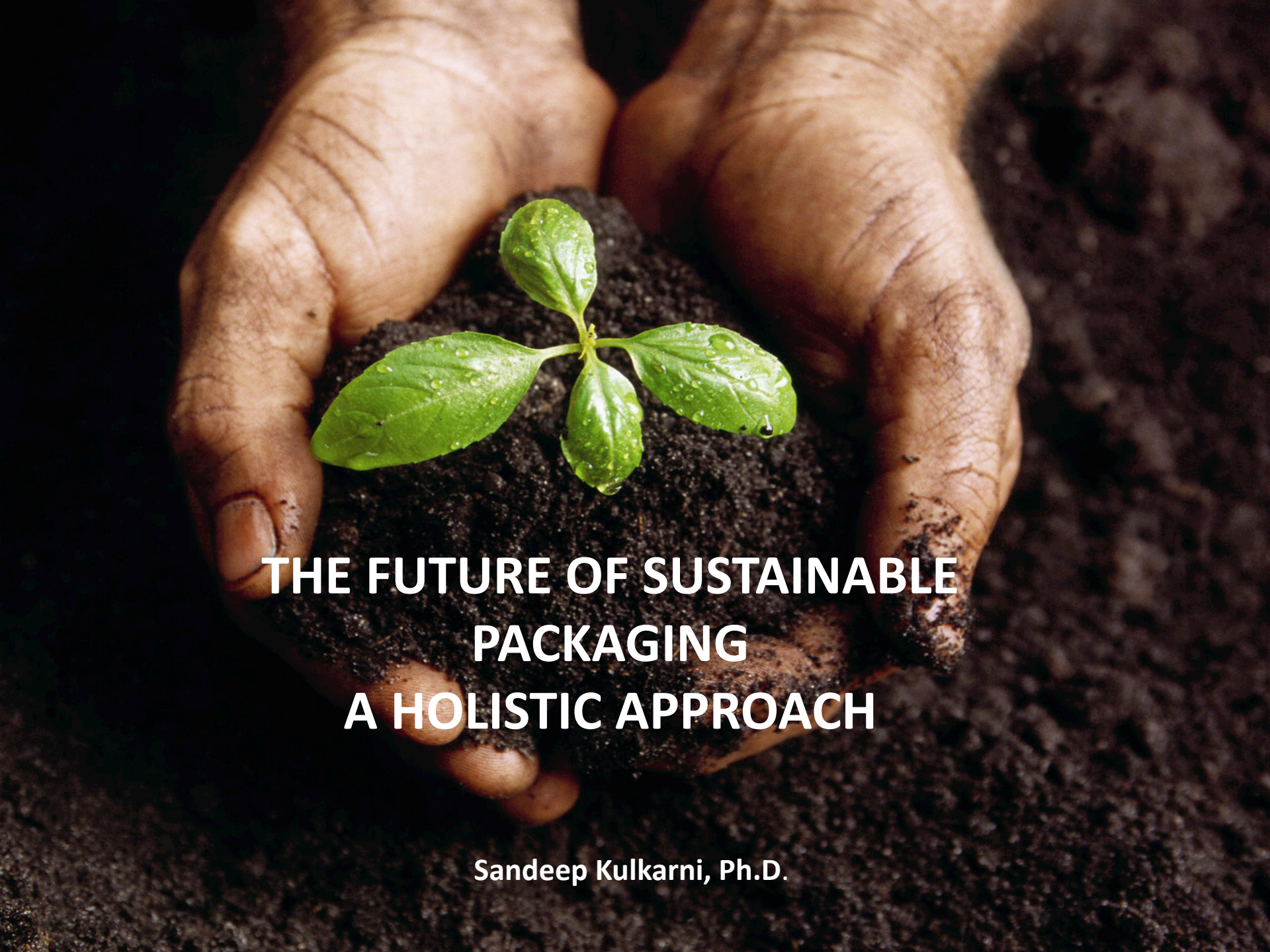
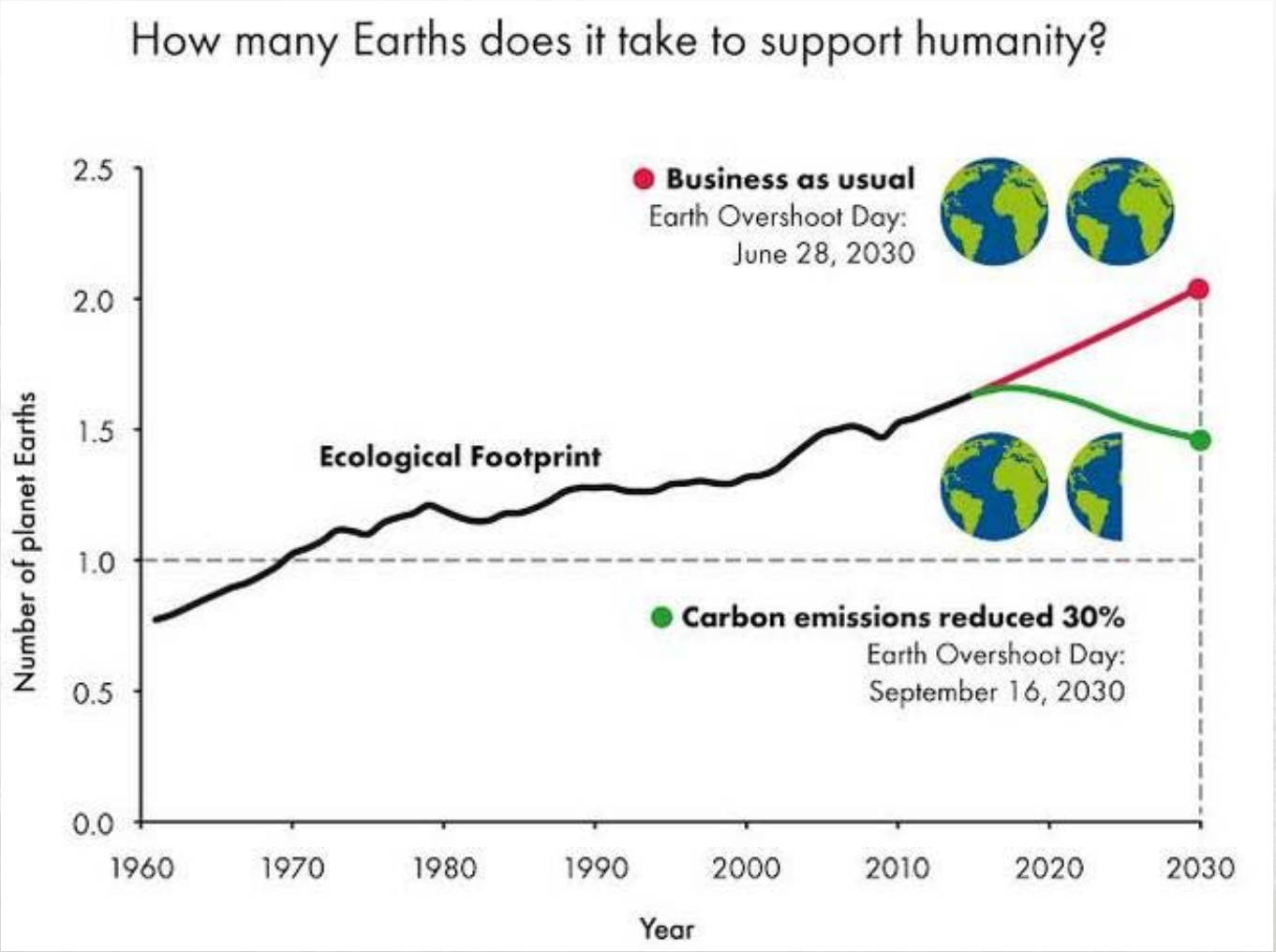


THE FUTURE OF SUSTAINABLE PACKAGING
A HOLISTIC APPROACH

Sandeep Kulkarni, Ph.D.

Demand for renewable ecological resources

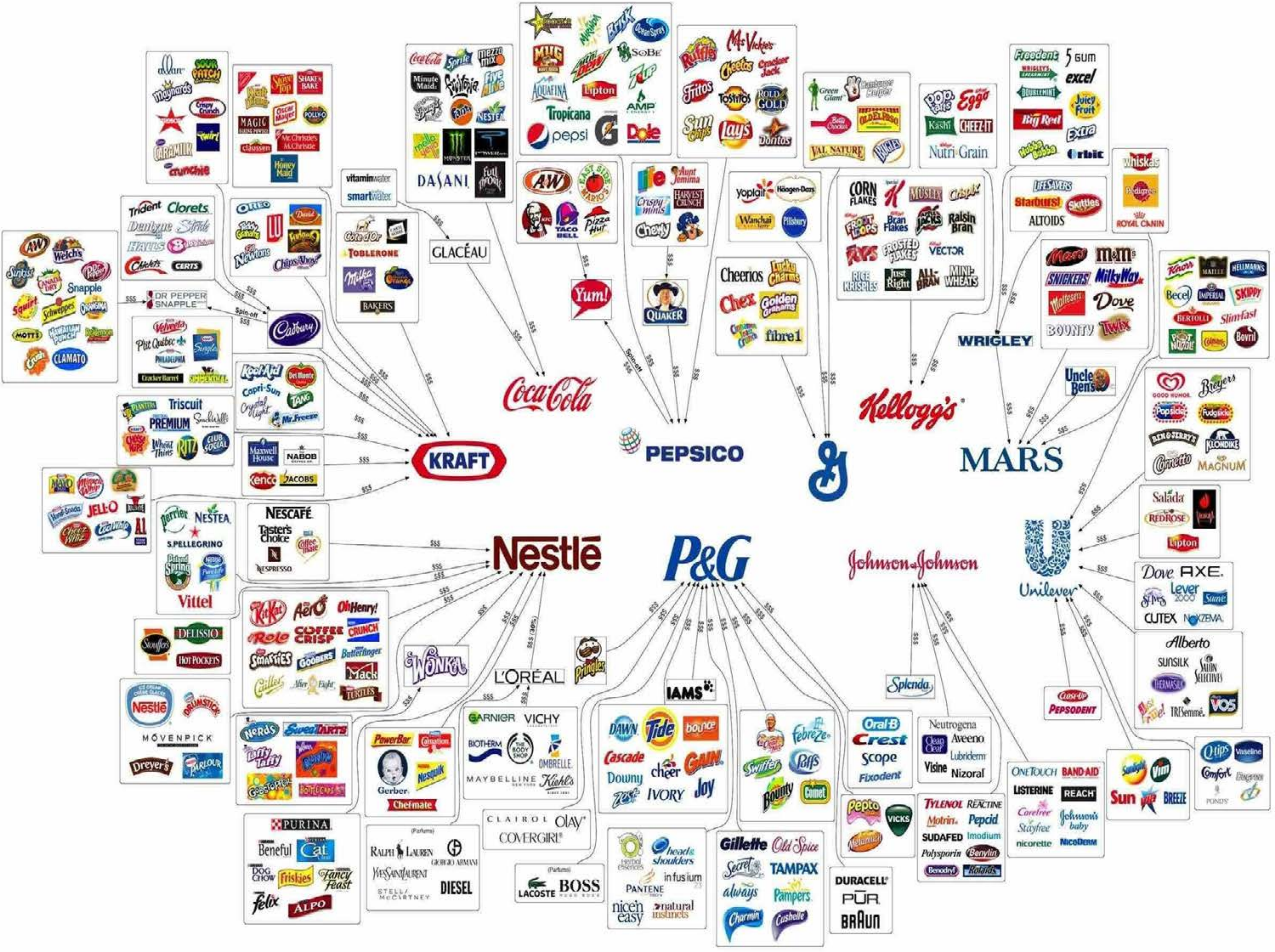
Living Planet/WWF 2014



Why sustainability matters and trends

Quantifying sustainability

Opportunities and challenges in sustainable packaging



KRAFT
Coca-Cola
PEPSICO
Kellogg's
MARS
Nestlé
P&G
Johnson & Johnson
Unilever
Yum!
QUAKER
GLACÉAU
WRIGLEY
Cadbury
DR PEPPER SNAPPLE
Spin-off
$$$
$$$ (30%)
L'ORÉAL
WONKA
Pringles
IAMS
Splenda
Uncle Ben's
Pepsodent
vitaminwater
smartwater
Trident
Clorets
Dentyne
Stride
HALLS
Chiclets
CERTS
OREO
Chips Ahoy!
Toblerone
Milka
BAKERS
Côte d'Or
Welch's
Sunkist
Snapple
Schweppes
Canada Dry
Mott's
Hawaiian Punch
CLAMATO
Velveeta
Philadelphia
Triscuit
PREMIUM
Wheat Thins
RITZ
Kool-Aid
Capri-Sun
Crystal Light
TANG
Maxwell House
NABOB
Kenco
JACOBS
JELL-O
Cheez Whiz
Cool Whip
A1
Caramilk
Crunchie
Maynards
Crispy Crunch
Oscar Mayer
Claussen
Honey Maid
MAGIC
Minute Maid
Sprite
Fanta
NESTEA
DASANI
Full Throttle
MONSTER
AQUAFINA
Tropicana
pepsi
Lipton
SoBe
Dole
AMP
Ocean Spray
Brisk
Ruffles
Cheetos
Fritos
Tostitos
Sun Chips
Lay's
Doritos
Cracker Jack
Rold Gold
Aunt Jemima
Harvest Crunch
Crispy Minis
Chewy
A&W
KFC
TACO BELL
Pizza Hut
Green Giant
Hamburger Helper
Betty Crocker
Old El Paso
VAL. NATURE
Bugles
Yoplait
Häagen-Dazs
Wanchai Ferry
Pillsbury
Cheerios
Lucky Charms
Chex
Golden Grahams
fibre1
Pop-Tarts
Eggo
Kashi
CHEEZ-IT
Nutri-Grain
CORN FLAKES
MUSLIX
Crispix
Froot Loops
Bran Flakes
Apple Jacks
Raisin Bran
Frosted Flakes
VECTOR
RICE KRISPIES
Just Right
ALL-BRAN
MINI-WHEATS
Freedent
5 GUM
excel
Doublemint
Juicy Fruit
Big Red
Extra
Hubba Bubba
Orbit
LIFESAVERS
Starburst
Skittles
ALTOIDS
Whiskas
Pedigree
ROYAL CANIN
Mars
m&m's
SNICKERS
Milky Way
Maltesers
Dove
BOUNTY
Twix
Knorr
HELLMANN'S
Becel
IMPERIAL
SKIPPY
BERTOLLI
Slim-fast
Bovril
GOOD HUMOR
Breyers
Popsicle
Fudgsicle
BEN & JERRY'S
KLONDIKE
Cornetto
MAGNUM
Salada
RED ROSE
Lipton
Dove
AXE
lever 2000
Suave
CUTEX
NOXZEMA
Alberto
SUNSILK
THERMASILK
TRESemmé
VO5
Q-tips
Vaseline
Comfort
PONDS
Sunlight
Vim
Sun
BREEZE
NESCAFÉ
Taster's Choice
Coffee-mate
NESPRESSO
Perrier
NESTEA
S.PELLEGRINO
Poland Spring
Pure Life
Vittel
KitKat
Aero
Oh Henry!
Rolo
COFFEE CRISP
CRUNCH
Smarties
GOOBERS
Butterfinger
Mack
Caillier
After Eight
TURTLES
Stouffer's
DELISSIO
HOT POCKETS
Nestlé
DRUMSTICK
MÖVENPICK
Dreyer's
PARLOUR
Nerds
SweeTARTS
Laffy Taffy
Gobstopper
PowerBar
Carnation
Gerber
Nesquik
Chef-mate
PURINA
Beneful
Cat Chow
Dog Chow
Friskies
Fancy Feast
Felix
ALPO
GARNIER
VICHY
BIOTHERM
THE BODY SHOP
MAYBELLINE
Kiehl's
OMBRELLE
(Parfums)
RALPH LAUREN
GIORGIO ARMANI
YVES SAINT LAURENT
STELLA McCARTNEY
DIESEL
CLAIROL
OLAY
COVERGIRL
LACOSTE
BOSS
DAWN
Tide
bounce
Cascade
GAIN
Downy
cheer
Zest
IVORY
Joy
Mr. Clean
febreze
Swiffer
Puffs
Bounty
Comet
Oral-B
Crest
Scope
Fixodent
Pepto Bismol
VICKS
Metamucil
head & shoulders
Herbal essences
infusium 23
PANTENE
nice'n easy
natural instincts
Gillette
Old Spice
Secret
TAMPAX
always
Pampers
Charmin
Cushelle
DURACELL
PŪR
BRAUN
Neutrogena
Clean & Clear
Aveeno
Lubriderm
Visine
Nizoral
ONE TOUCH
BAND-AID
LISTERINE
REACH
Carefree
Stayfree
Johnson's baby
nicorette
NicoDerm
TYLENOL
RÉACTINE
Motrin
Pepcid
SUDAFED
Imodium
Polysporin
Benylin
Benadryl
Rolaids

PepsiCo Packaging

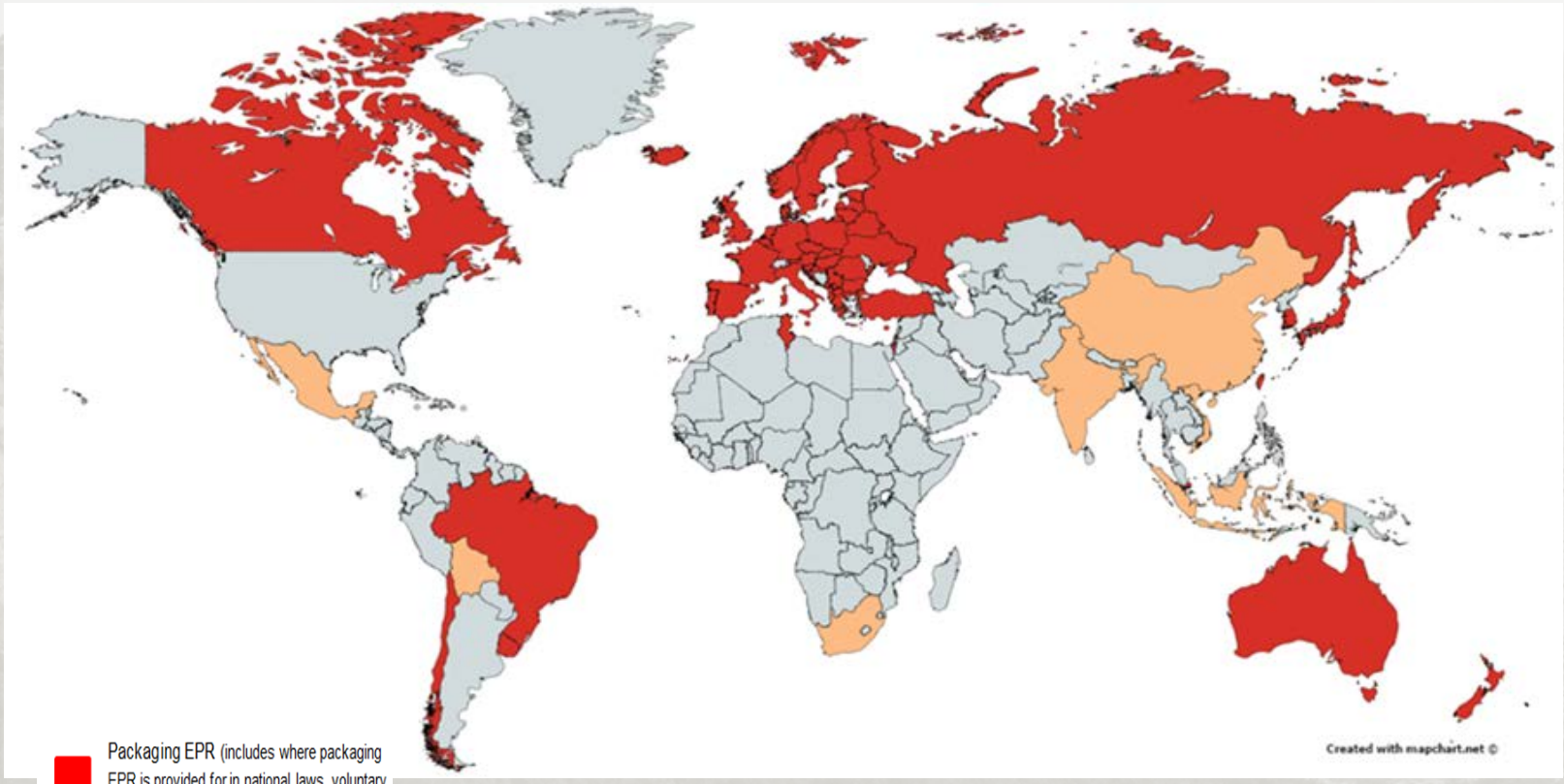
- ~2¼ Billion liters of beverage and ~4 Billion kilograms of food per year

- ~5 Million tons of packaging materials annually
  - PET
  - Aluminum and Steel
  - Glass
  - Corrugated Board and Paperboard
  - Flexible Packaging
  - Other

TRENDS/DRIVERS

- Government/Regulatory (EPR fees)
- NGO pressures
- Consumer preferences
- Corporate commitments

PACKAGING FEES/TAXES



CORPORATE COMMITMENTS

Unilever

PEPSICO

PRODUCTS PLANET PEOPLE

PEPSICO

PLANET

20% GHG REDUCTION

100% PKG RECYCLABLE/RECOVERABLE
PARTNER TO INCREASE RECYCLING

DEFINING SUSTAINABILITY

Economy

Environment

Employees & People

PRODUCTS PLANET PEOPLE


WE'RE
GREEN!

“GREENWASHING” HAS CAUSED MISTRUST

Sustainable Packaging: Working Definition

SUSTAINABLE PACKAGING COALITION®
A PROJECT OF GREENBLUE

http://www.sustainablepackaging.org/

- *Is beneficial, safe & healthy for individuals and communities throughout its life cycle*
- *Meets market criteria for both performance and cost*
- *Is sourced, manufactured, transported, and recycled using renewable energy*
- *Optimizes the use of renewable or recycled source materials*
- *Is manufactured using clean production technologies and best practices*
- *Is made from materials healthy throughout the life cycle*
- *Is physically designed to optimize materials and energy*
- *Is effectively recovered and utilized in biological and/or industrial closed loop cycles*

Attempts to "Quantify" Sustainable Packaging

Life Cycle Assessment (LCA)

- Accepted technique to assess environmental impacts associated with all stages of a product's life from cradle to grave
- International standards *e.g.*, ISO 14040, ISO 14044 and PAS 2050

Relevant impact categories

GHG Emissions (Carbon Footprint) [kg CO_2e]

Total Energy Consumption [MJ]

Solid Waste [kg]

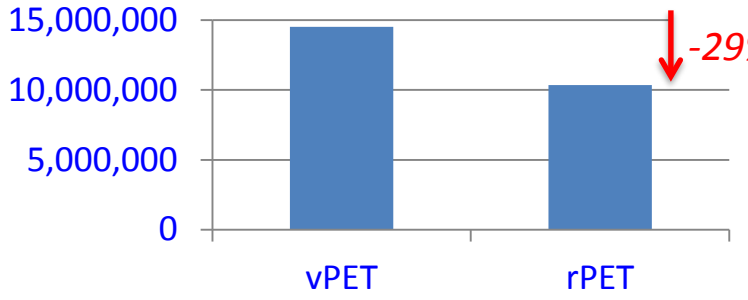
Water Consumption [m^3]

- **Results dependent on system boundaries:**
  - **Cradle-to-Material (or Gate)**
  - **Cradle-to-Grave**

Life Cycle Results: Naked Juice reNEWabottle Bottle (100% rPET)

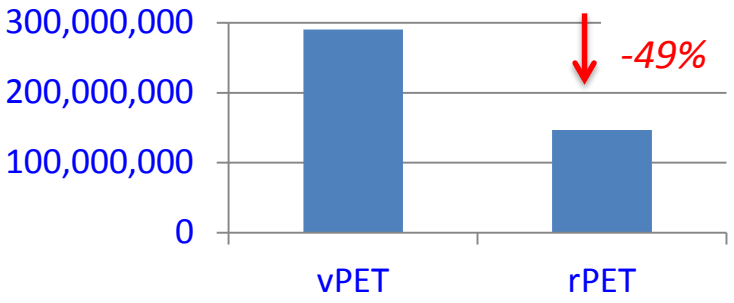
15.2 oz. 24 g bottle, 2010 sales (cut-off method)

Greenhouse Gas Emission
[kg CO_2e]

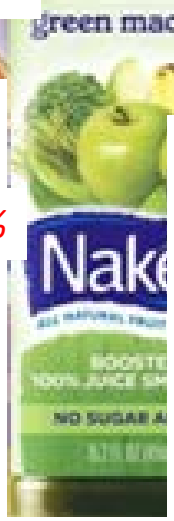


- *680 passenger cars off road*

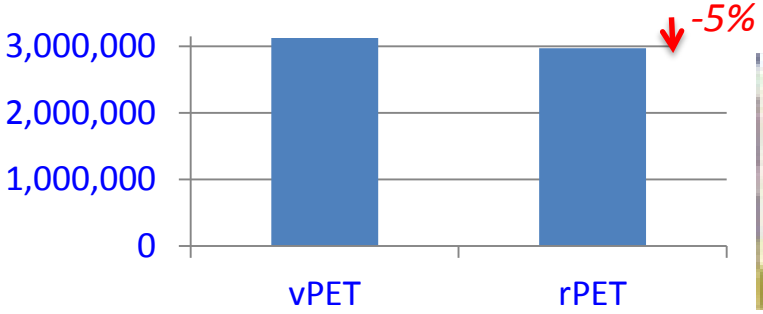
Total Energy Demand
[MJ]



- *0.9 million gallons of gasoline saved*
- *630 homes energy use*

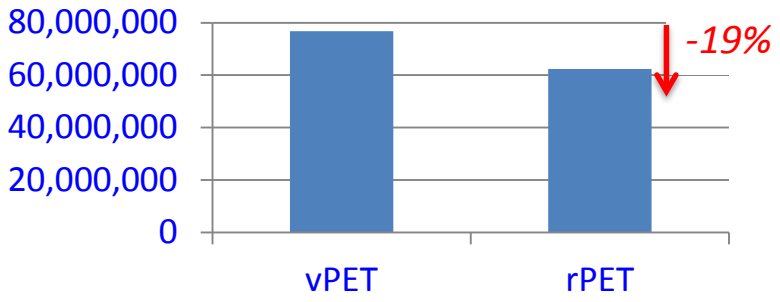


Solid Waste
[kg]



- *200 tons municipal solid waste per capita averted*

Water Consumption
[liters]



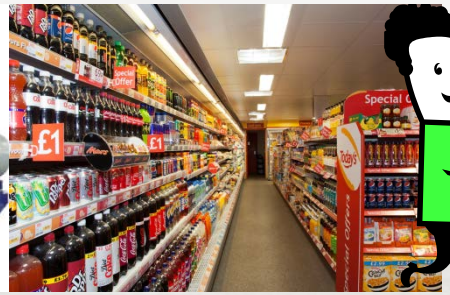
- *150 gal indoor water use per capita avoided*

Future opportunities

Global sustainable packaging market - $ 244 Billion by 2018

Smithers Pira Report

Packaging Value Chain *(simplified)*



Materials → **Converters** → **Brand Owners / Retailers** → **Consumers** → **End of Life**

Sustainability opportunities at each step of value chain

Bioplastics from non-food (cellulosic) biomass sources

- Non-biodegradable (PET, PE, PEF) or biodegradable (PLA)
- Agricultural residues (corn stover, bagasse, oat hulls)
- Focus on multi-product manufacturing (biorefinery)

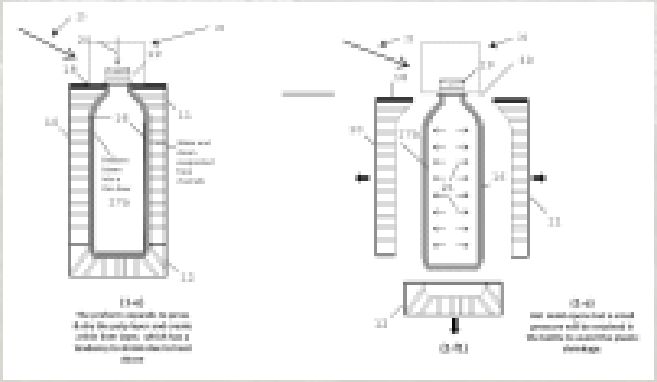
Molded fiber packaging

- **Plastic pouch in molded pulp clamshell (Ecologic, GreenBottle)**

- **Molded pulp protective packaging**

DELL

- **Fiber based bottle under development (Carlsberg/ecoXpac, PepsiCo)**



Non-traditional fiber packaging

- Bamboo fiber
- Wheat fiber
- Bagasse
- Mushroom

Kimberly-Clark

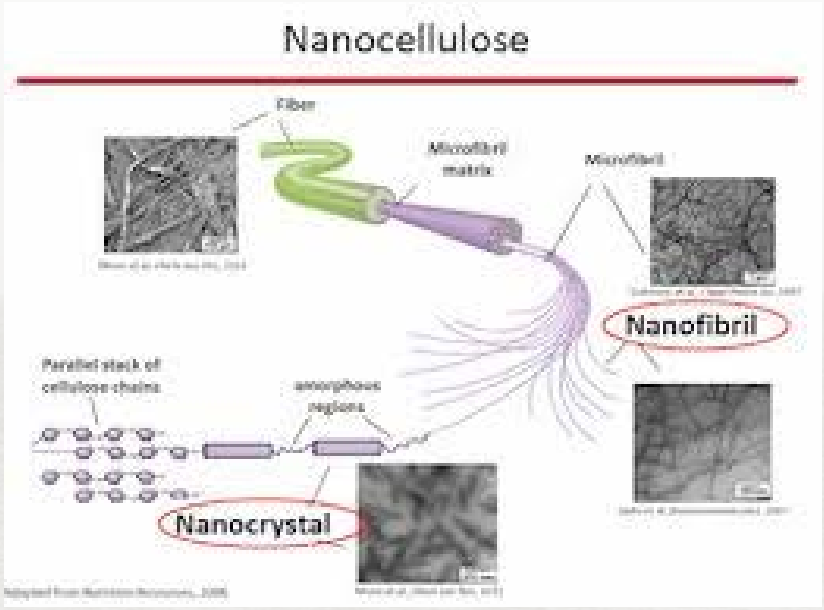
Veritiv

DELL

UGS
a division of Unisource Worldwide, Inc.
Products & Packaging in Harmony

ecovative

Nanocellulose



- CNF and CNC
- Barrier coating, strength enhancement
- Semi-commercial

AMERICAN PROCESS

IMERYS
TRANSFORM TO PERFORM

Forest Products Laboratory

Environmentally friendly barrier coatings

- Mineral filled coatings

smartplanet technologies™

- Bio-based/edible barrier coatings

Mantrose-Haeuser Co., Inc.

wiki foods™

Conclusions

- Sustainability and sustainable packaging is a critical component of corporate strategy

- Objective and science-based approaches necessary to measure sustainability performance

- Sustainable packaging presents several opportunities in value chain
  - Price / Performance ratio is difficult to compromise!
  - No panoptic solutions exist!
  - Opportunities beyond just “bio-based” packaging

One planet earth is sufficient if we do it right

Thank you!

Appendix

OUTLINE OF A CIRCULAR ECONOMY

PRINCIPLE 1

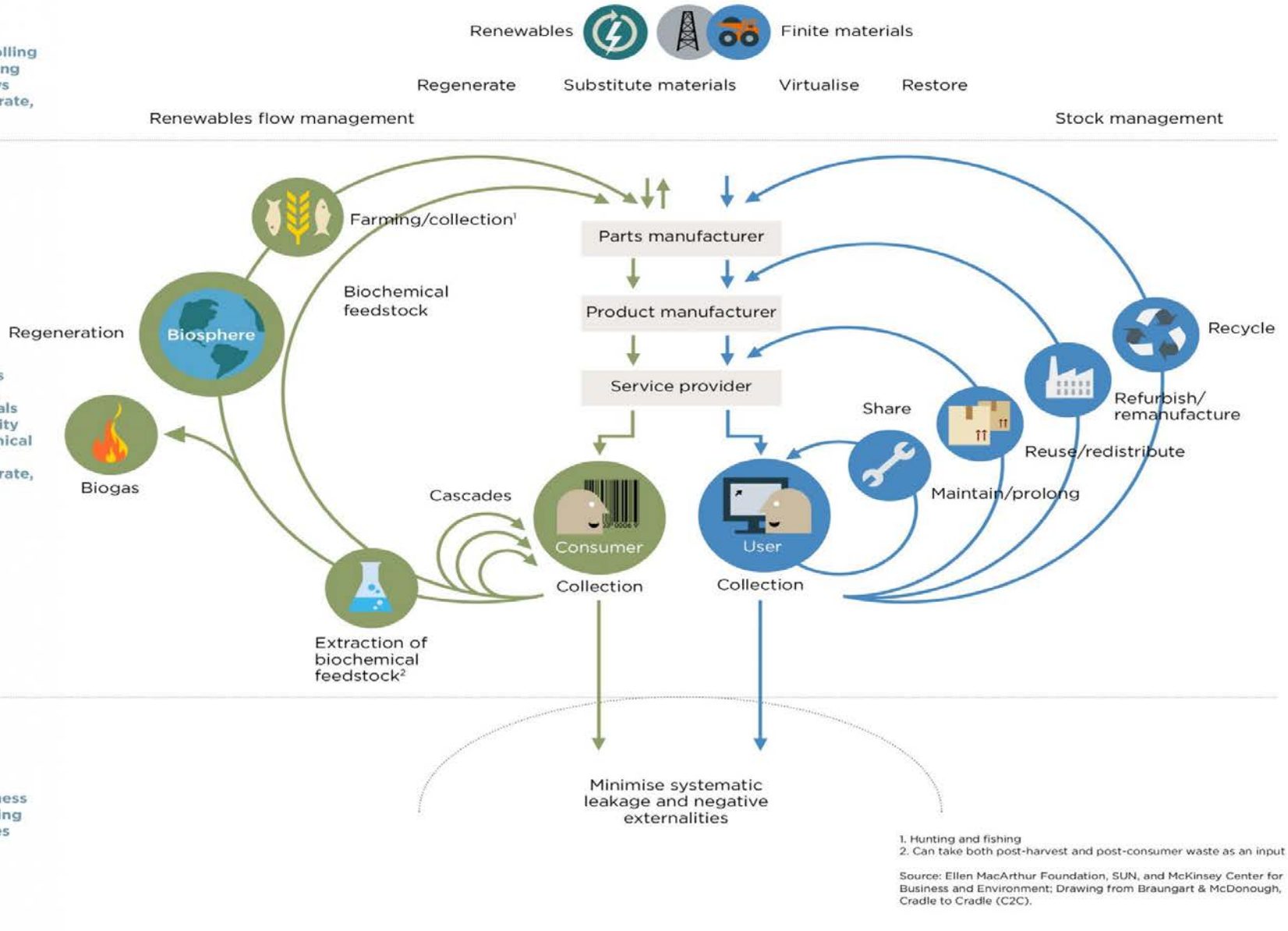
Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows
ReSOLVE levers: regenerate, virtualise, exchange

PRINCIPLE 2

Optimise resource yields by circulating products, components and materials in use at the highest utility at all times in both technical and biological cycles
ReSOLVE levers: regenerate, share, optimise, loop

PRINCIPLE 3

Foster system effectiveness by revealing and designing out negative externalities
All ReSOLVE levers



1. Hunting and fishing
2. Can take both post-harvest and post-consumer waste as an input

Source: Ellen MacArthur Foundation, SUN, and McKinsey Center for Business and Environment; Drawing from Braungart & McDonough, Cradle to Cradle (C2C).

Circular Economy