

Sustainability – A Change in Climate?

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Simply Sustain Consulting

- Affiliated with MIT, Society for Organizational Learning, Sustainability Consortium
- Sustainability through collaborations and education
- Greening of PP, April 2007 Roundtable
 - 65 people, 30 companies in the value chain, from cradle to cradle
- Multi-client Report on PP Sustainability
 - Life Cycle Impacts of PP vs bio polymers, end-of-life options
- Recycling PP, Jan 2008 Roundtable
 - Included municipalities, MRFs and plastics re-processors
 - Project team - ACC, US EPA and private companies

Outline

- Plastics and sustainability
- Bio plastics innovations
- Greening of Petro plastics
- Case studies
- Design and innovation
- Steps to changing the climate

Petro Plastics - Growing Restrictions

- **Profits**
 - Flat demand and growth, Escalating costs & Margin squeeze
- **People**
 - Retailers - Wal-Mart, Tesco - material de-selection
 - Consumer Product Groups - Carbon labels
 - Regulators - California, Europe
 - Municipalities - Plastic bans
 - NGOs - challenging credibility of industry funded science
 - 70% increase in state and local attacks (2006-7)
- **Planet**
 - Use of Non-renewable energy - 4% of crude understatement
 - Release old fossilized carbon - GHG
 - Waste, >70 billion lbs/yr to landfills in the US
 - Liter and Marine debris

UK Retailers Environmental Commitment

- M&S – £250 million Plan A (because there is no Plan B) – Recyclable Packaging, Plastic bag charge
- Tesco - £500 million environmental program (lightweighting, energy efficiency, carbon footprint)



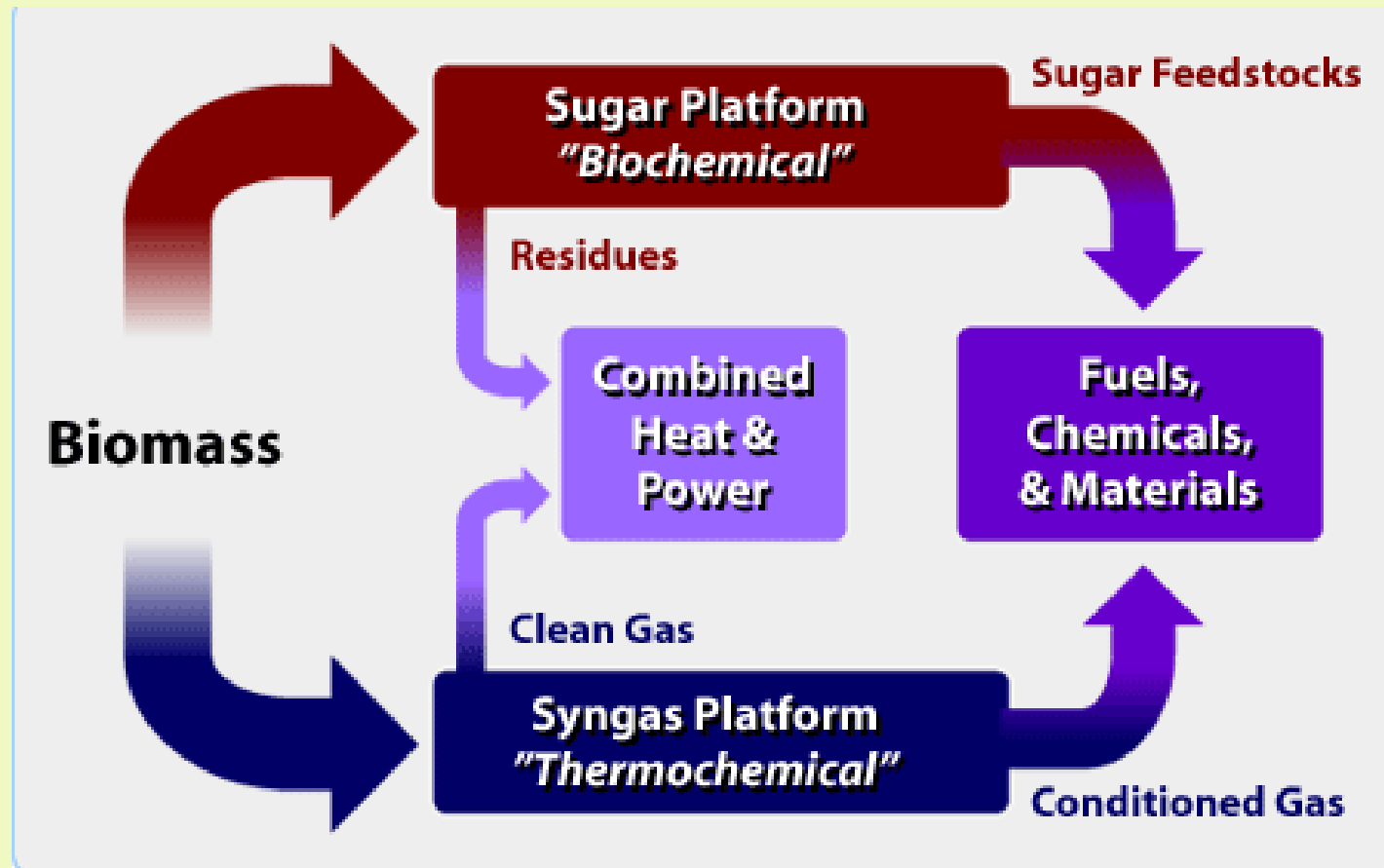
Aims of Bio Plastics Innovations

- Reduce non-renewable energy consumption through the use of new technologies.
- Reduce or eliminate
 - Greenhouse gases emissions
 - End-of life waste and associated environmental and societal impacts
- Gain societal acceptance

Growing Choice of Bio Plastics

Sugarcane	Fermentation	Bio PE, Dow, Braskem
Agri-waste	Thermo-Chemical	Bio Polyolefins, Lurgi, UOP
Sugar wastes,	Microbial	(PHA & PHB) Metabolix
Corn & other starches	Chemical modification	Thermo plastic starches, Novamont
Corn & other starches	Enzymes, Chemical	PLA, Nature Works, PTT, DuPont
Oil Seeds	Trans-esterification	Bio Polyols, Dow

Bio Refinery Concept (NREL)



Potentially carbon neutral vs Petro-refineries.

Bio Plastics Emergence

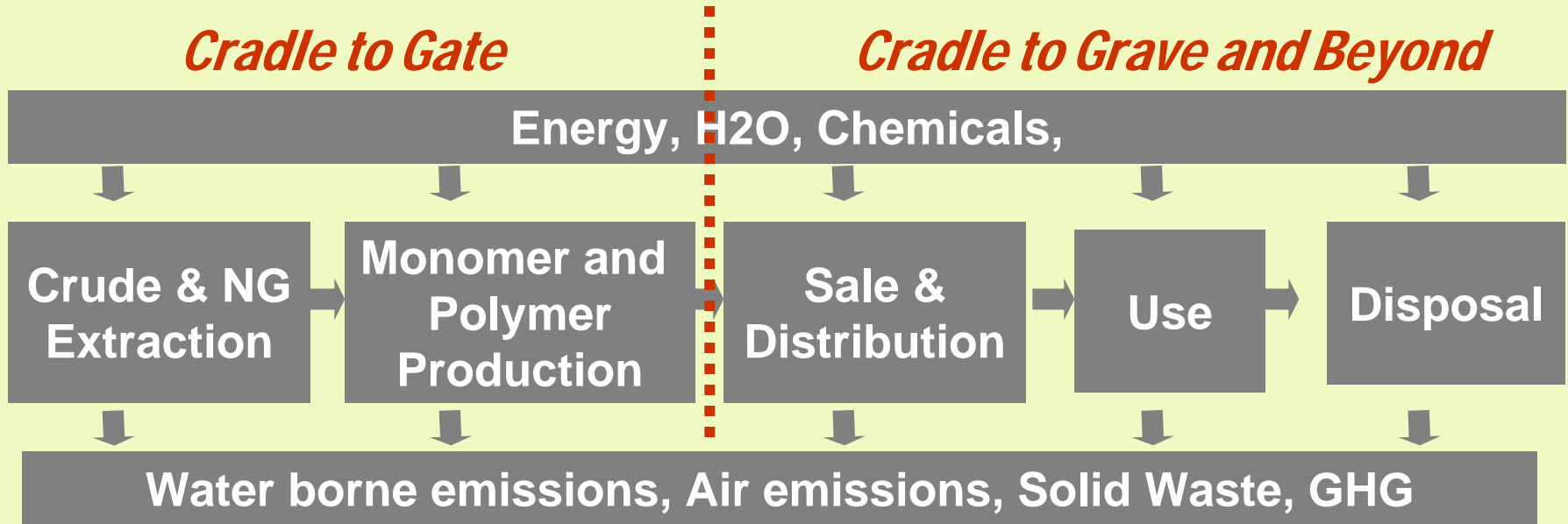
DRIVERS

- Bio-tech advances
- Venture capital
- Bio fuels
- Strategic Shift
 - DuPont
- Consumer Appeal
- Federal Purchasing Bio-preferred

IMPLICATIONS

- Competition w food
- Land, bio-diversity
- Water
- Monetization of food, wood and agri waste
- Regional plants
- Single polymer plants
- Low capital entry

Life Cycle Impacts & Assessment (LCI, LCA)

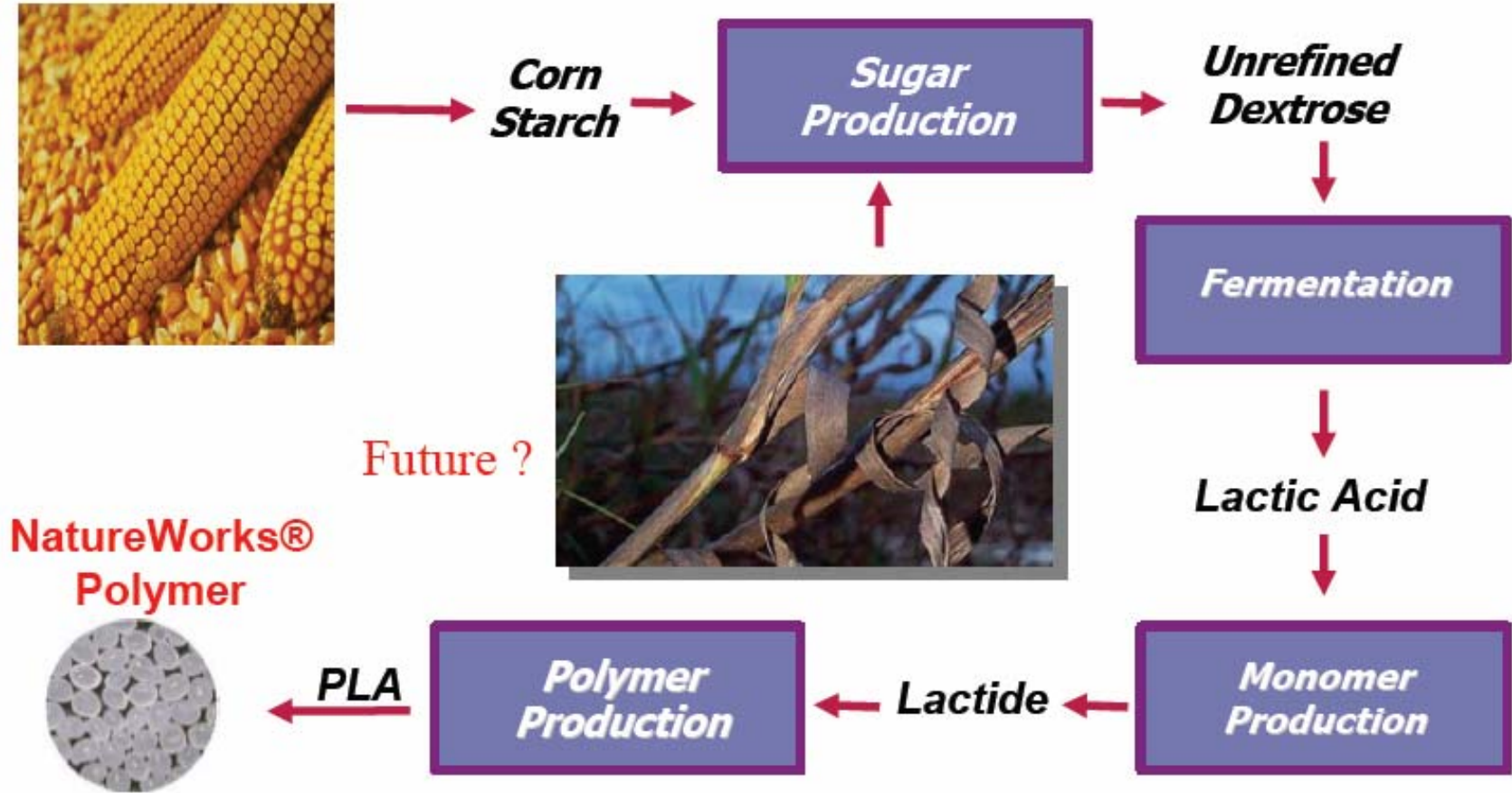


- ***Very complex and evolving methodology***
- ***Easy to misuse for material comparison***
- ***Powerful tool for benchmarking and continuous improvement***

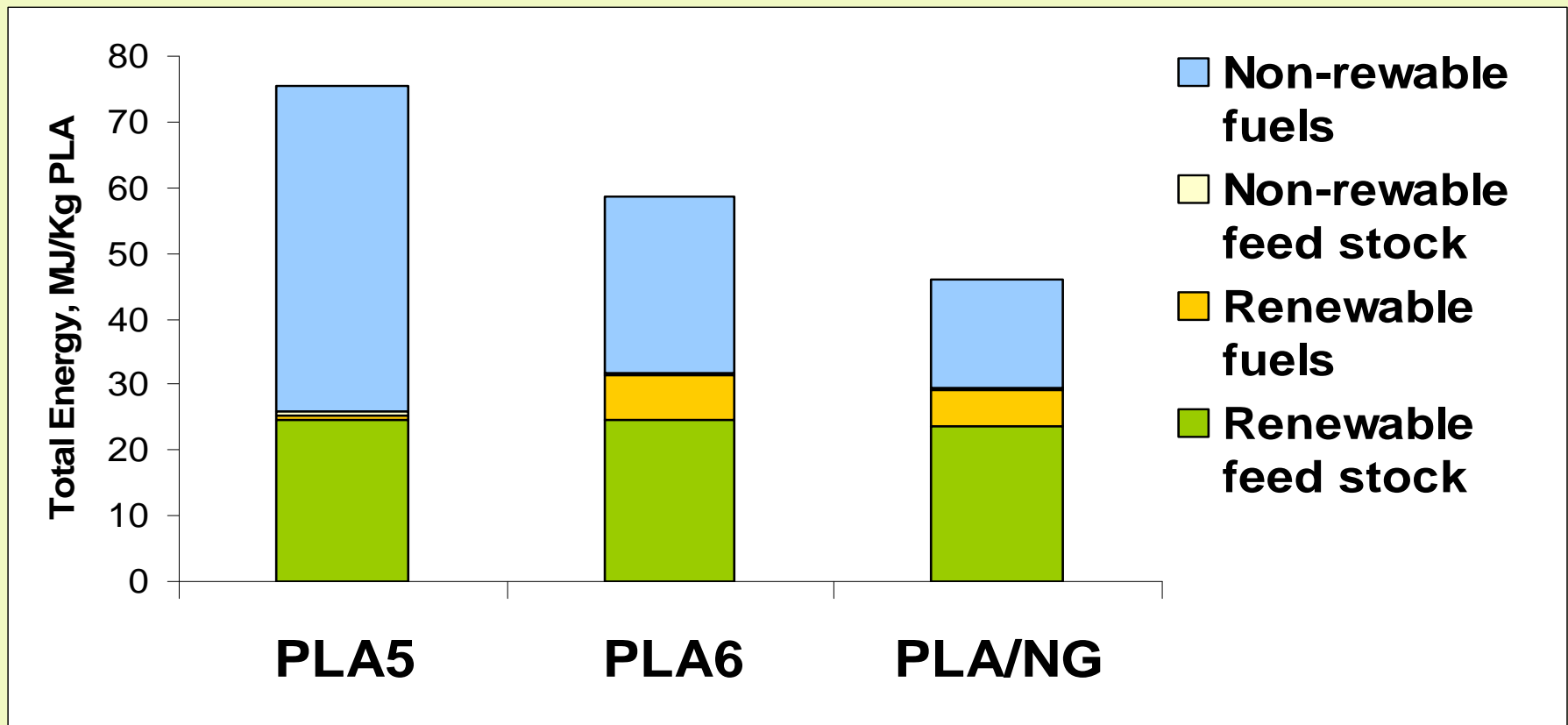
Poly Lactic Acid (PLA)

http://www.les2007.com/presentation/Me_2_04_Visk.pdf

PLA Manufacturing Overview



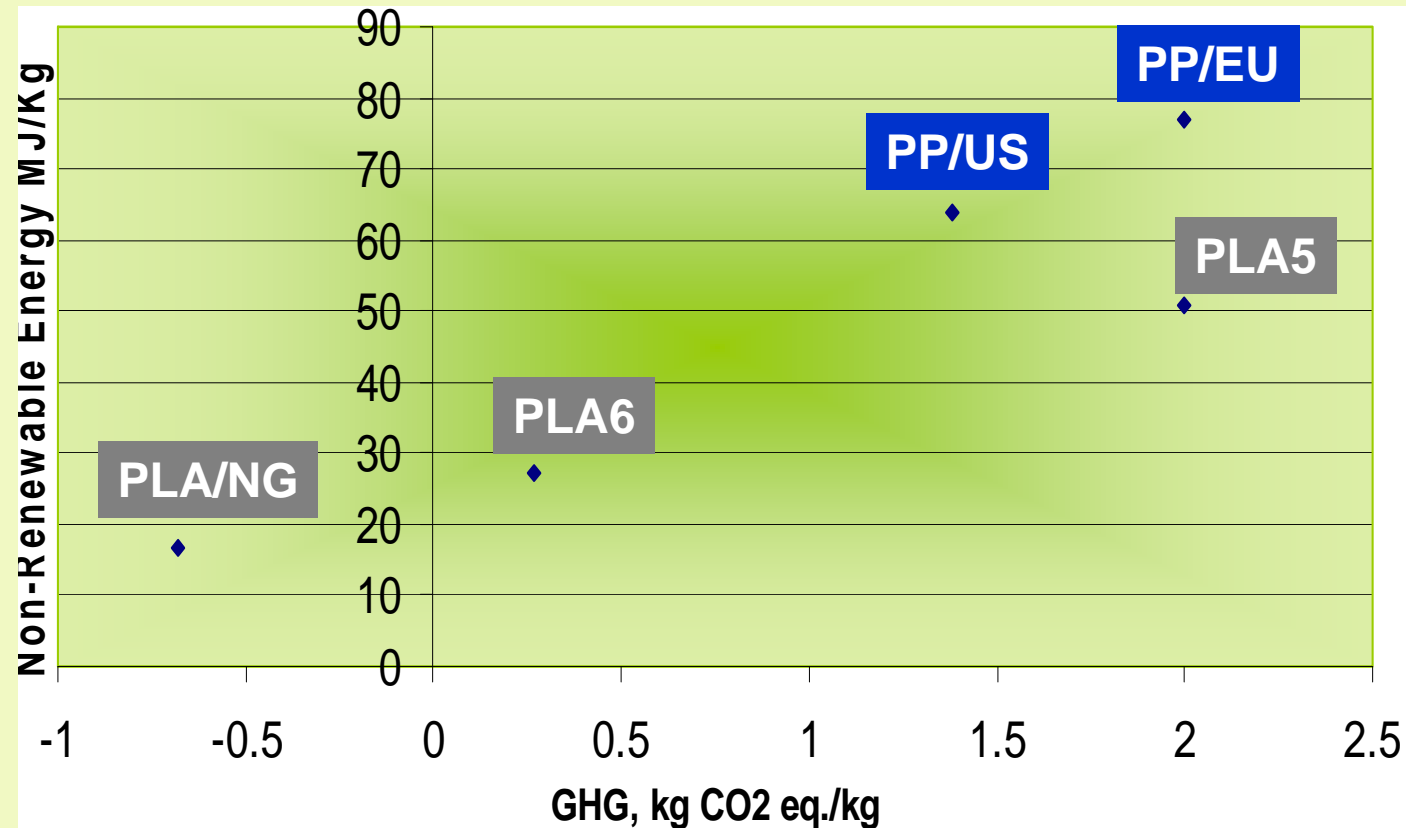
Driving Down Non-Renewable Energy



In PLA6 grid electricity is replaced with wind renewable energy credits.

***Fossil-based electricity generation is extremely inefficient!!
To make and deliver 1MJ needs 3.5 MJ of fossil energy***

PP & PLA, Cradle to Gate Energy Vs CO₂



Beware Of:

- Age of data
- Industry participation
- Methodology
- Regionality
- Density



***Does this mean Bio Plastics are
environmentally the best choice?***

Yogurt Delivery System

- University Of Michigan comparison of
 - Impacts on Energy, Solid waste, Water, Air and Water emissions
 - PP, PLA, HDPE, Coated Unbleached Paper
- No single material best in all sizes and in all burdens
- PP tubs being lightest have lowest solid waste burden
- Thermoformed PP cups weigh 13-30% less than Injection molded cups and use 20% less energy
- Distribution has the highest burden in all impact categories
 - Secondary packaging production uses 56% of the energy

Optimize Energy and carbon in total delivery system, not just the plastic

PP Trays For Packaging Chicken

Sharp Interpack	Faccenda Group	ASDA
<p>Tray depth from 35 to 30 mm reduced:</p> <ul style="list-style-type: none"> ● PP use by 273 tons in 2007 ● Transportation ● Conversion energy 	<p>1 extra tray per unit outer casing reduced:</p> <ul style="list-style-type: none"> ● 2000 outer cases and 57 pallets/wk ● Pallet & peak storage ● Trips & transport ● Secondary packaging ● Cost/kg of delivered chicken by 20% 	<p>Increased shelf capacity in store & reduced:</p> <ul style="list-style-type: none"> ● Transport to RDC ● Pallets to load, labor ● In store transport ● Frequency of reloading ● Storage costs in RDC ● Storage costs in back-up refrigeration ● Water & soap

Collaborate with supply chain. Small change in design can give big monetary benefits, beyond your boundary in the whole supply chain

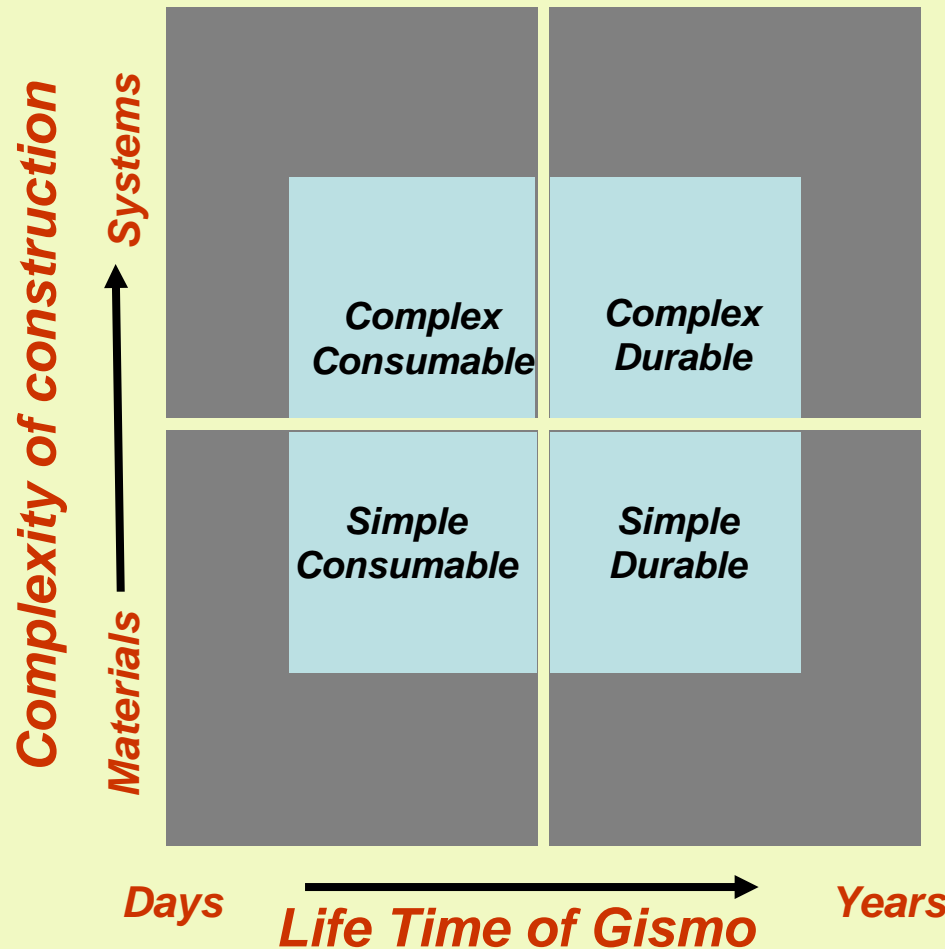
Neither Bio nor Petro Ideal Today

- Neither provide acceptable end-of-life solutions
 - Only PET and HDPE bottles are recycled today.
 - Mixed plastics waste going to China.
 - PLA currently not recycled, contaminates PET stream
 - PLA is only compostable in industrial composters
 - Starch & cellulose packaging - home compostable.
 - biodegradable' plastic bags were NOT truly biodegradable
 - PE bags with starch additives or oxo/photo degradable additives result in hundreds of PE film fragments!!!

The Innovation Challenge

- ***It is not just about more recycling.***
- ***Gismos are not designed for easy recovery of plastics.***
- ***Life time of Gismos is all wrong.***
 - ***Consumables live far too long, durables live not long enough***
- ***It Is About Time.....***
 -To Re-design , Innovate for next life and Extend Time Value of Plastics.***

A Design Framework From Simply Sustain



Materials available within weeks, but recovery costs are high

Materials not available for years and recovery costs are high

Materials available within weeks and recovery costs are lower

Materials not available for years, but recovery costs are lower

Simply Sustain Design Framework

To Extend Time Value of Materials

•Design For Simplicity

E,g
Japanese covenant – no pigments in bottles

•Innovative collection & plastics separation

Complexity of construction



•Design For Dis-Assembly

HP, Xerox

•Design For Durability

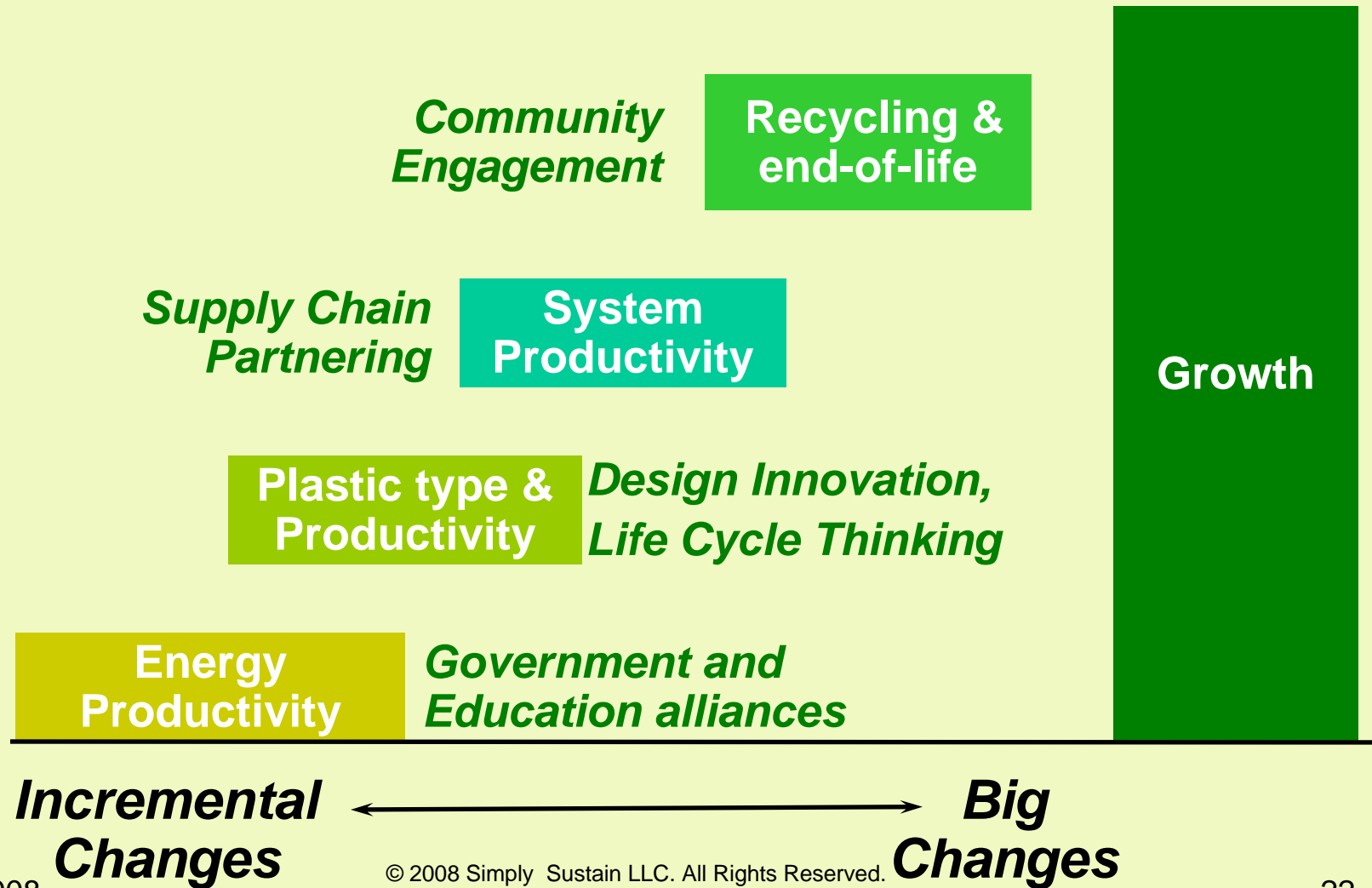
•Collect at Point of Sale

Life Time of Gismo

Summary

- Optimizing the plastic alone is not enough!!
 - Plastic, gismo design, delivery, use, disposal are connected and have many trade-offs, balances
- Supply chain partnerships to reduce energy, carbon and waste
- LCIs key tools for continuous improvement
- Redesign for next life
- Engage with public
- Innovate to green Plastics for growth

Steps to Sustaining Growth



Thank You !!