



Taking Green Mainstream

Keeping Pace with the Consumer,
Anticipating Educational Needs

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Everything You Know is Wrong...



Everything You Know is Wrong...

A. The best performance does not always win

1. Great ideas are not enough

- a. Apple Newton (PDA, tablet forerunner)
- b. Polaroid Polavision (instant movies, actually launched *after* video cameras)
- c. Amphicar
- d. “A great idea is a job half done”



Everything You Know is Wrong...

- A. The best performance does not always win
 - 1. Great ideas are not enough
 - 2. Great technology is not enough
 - a. Apple Lisa (Macintosh forerunner)
 - b. Sony's Betamax (videocassette format standard)
 - c. Ricochet Wireless ISP (G3 broadband forerunner)



Everything You Know is Wrong...

A. The best performance does not always win

1. Great ideas are not enough
2. Great technology is not enough
3. Great execution is not enough
 - a. Supersonic transport (e.g., Concorde)
 - b. DeLorean DMC-12
 - c. Febreze® Scentstories (air freshener CD player)

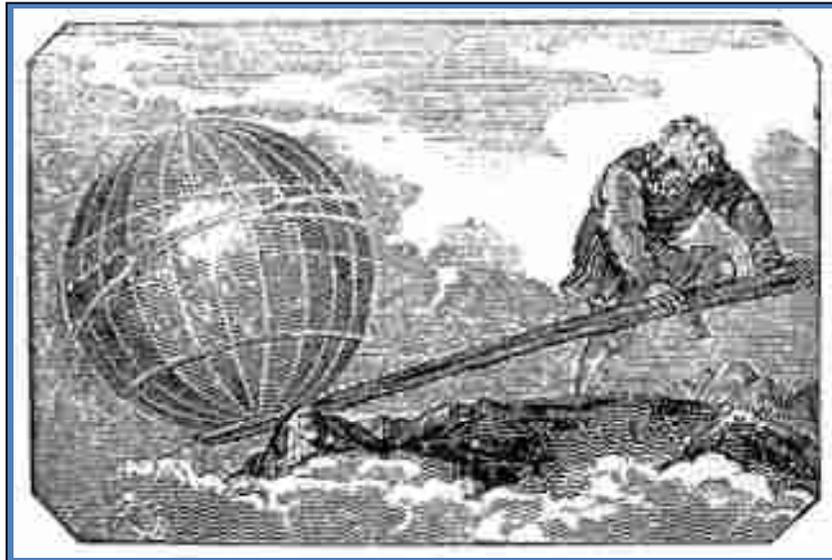


Everything You Know is Wrong...

- A. The best performance does not always win
 - 1. Great ideas are not enough
 - 2. Great technology is not enough
 - 3. Great execution is not enough
 - 4. Reality check – win the hearts of the consumer!
 - a. Consumers value cheaper, faster – “90% rule”
 - b. People want products that are convenient
 - c. Packaging – the first impression
 - d. People want products that make their belongings smell better-than-new

Everything You Know is Wrong...

A. The best performance does not always win



Engraving from *Mechanics Magazine*, London, 1824

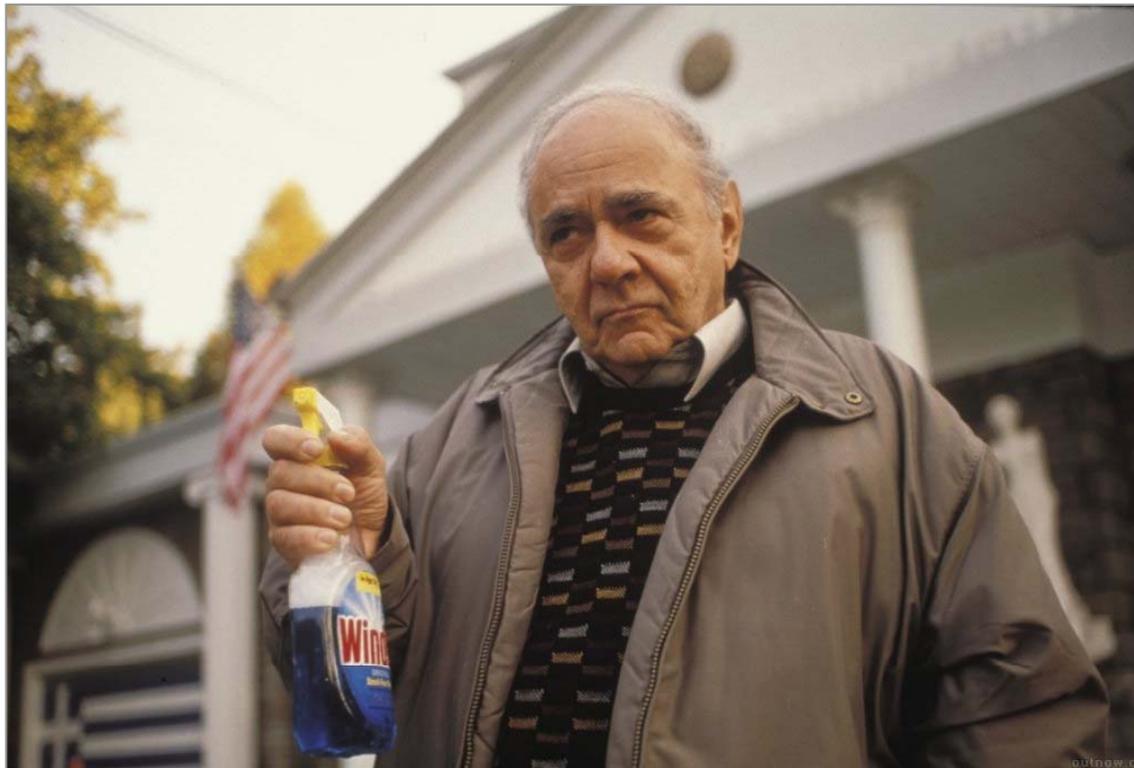
*"Give me a place to stand,
and I will move the world."*

Archimedes (287-212 B.C.)

- Mark Twain: *"Suppose he had moved the earth, what then? What benefit would it have been to anybody?"*
- Primary task: listen to – hear – the voice of the consumer!

Everything You Know is Wrong...

B. Sometimes, it comes down to luck....

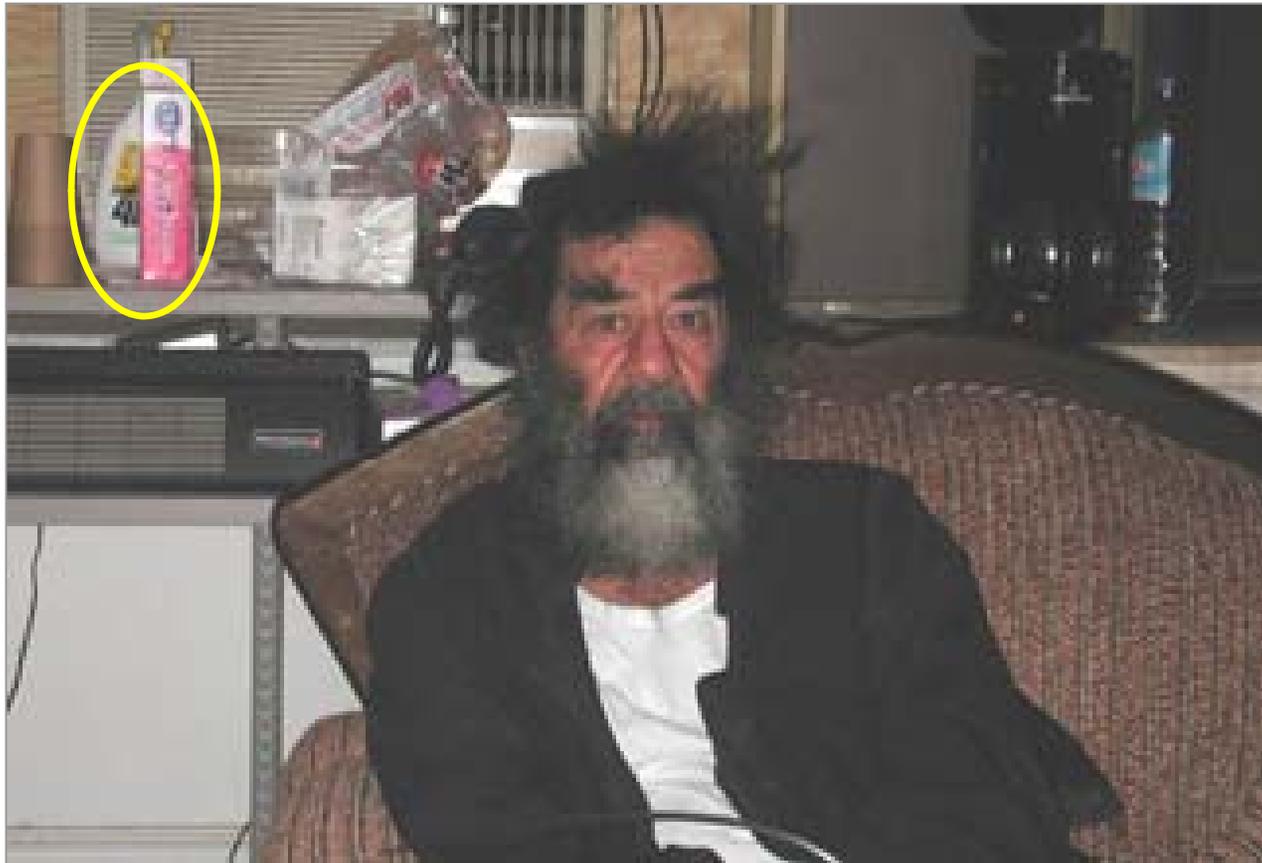


“I’ll get the Windex”

-- Michael Constantine
My Big Fat Greek Wedding

Everything You Know is Wrong...

B. Sometimes, it comes down to luck....



Everything You Know is Wrong...

B. Sometimes, it comes down to luck....



...or missed opportunities?

Everything You Know is Wrong...

C. Reality versus Ideality – what is the *real* world?

1. Far from equilibrium versus at or near equilibrium
2. Pretty close to ambient all the time
3. Pretty close to atmospheric pressure all the time
4. Rarely, if ever, pure systems
 - a. Mixed solvents (e.g., never pure water)
 - b. Mixed nature of target molecules (hydrophilic versus hydrophobic)

Everything You Know is Wrong... but that's OK

- D. Almost *no* one comes in the door of a company such as Clorox with what they need to succeed from Day 1
 - 1. Companies need to provide a program that at least looks to supplement the chemistry basics with “the rest of the story”
 - a. Basics of formulation – the nature of stains and soils, the palette of raw materials available
 - b. Colloids: formulating for performance and stability
 - c. Safety, environmental, and regulatory compliance
 - 2. Best to have a support network (mentors, advisors, “People of the Book”) – be proactive in seeking out “go-to” people for knowledge
 - 3. Early learning at the bench is absolutely critical – eyes-on, hands-on, noses-on – to resetting your paradigms

Formulation Basics

Basics of Formulating Cleaning Products

*A Primer for Training of
Product Developers*

Gregory van Buskirk

Formulation Basics

Training Goals

- **Nature of Soils and Surfaces**
 - Why Things Get Dirty (and stay dirty)
 - Whadya Gonna Do About It?
- **Formulation Palette**
 - What Ingredients Are There
 - Why Are They Used?
- **Surfactants**
 - Ionics (anionics, cationics, zwitterionics)
 - Nonionics (alcohol alkoxyates, glucosides, amphoteric)



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Formulation Basics

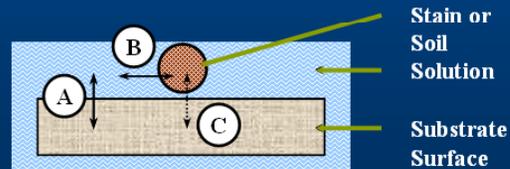
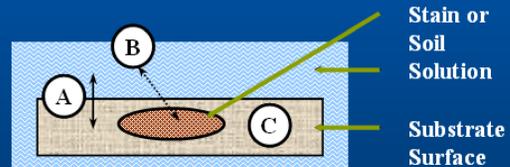
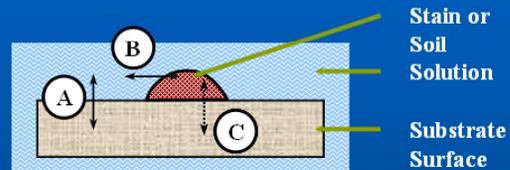
Training Goals

- **Builders**
- **Bleaches**
 - Halogen
 - Oxygen
- **Enzymes**
- **Adjuvants (solvents, hydrotropes, polymers, thickeners, brighteners, antimicrobials)**
- **Water (no... really!)**

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Formulation Basics

Forces Between Substrate, Soil, and Cleaning Solution, recap



Our Game

- A: Solution – Surface Interaction
- B: Solution – Stain/Soil Interaction

“Worst Case”
Embedded soils

“Problem Solved”

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Formulation Basics

Surfactant Types

- **Anionics**
 - Sulfates, sulfonates, disulfonates
 - Carboxylates
 - Phosphate esters
 - Sulfosuccinates, sulfosuccinamates
 - Sarcosinates, glutamates
- **Nonionics**
 - Ethoxylates, propoxylates
 - Glucosides
 - Amides
 - Esters
- **Cationics**
 - Quaternary ammonium salts
 - Quaternary phosphonium salts
- **Amphoterics/Zwitterionics**
 - Amines, amine oxides (depending on pH)
 - Betaines
 - Combination of amines with carboxylates or sulfonates
 - Imidazoline derivatives: acetates and propionates

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Formulation Basics

Builder Types

- **Sequestering**
 - Phosphates, polyphosphates
 - Silicates
 - Carboxylates (e.g., citrate, laurate, EDTA, NTA)
 - Some polymers (usually carboxylic, usually lower molecular weight)
- **Precipitating**
 - Carbonates
 - Orthophosphates
- **Ion Exchanging**
 - Zeolite A
 - Layered silicates

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Formulation Basics

Bleach Types

● Halogen

- Alkaline, alkaline earth hypohalites (e.g., sodium hypochlorite, calcium hypochlorite, lithium hypochlorite)
- Haloamines, halogenated isocyanurates, hydantoins
- Chlorine gas, bromine chloride

● Oxygen

- Hydrogen peroxide (including solids such as perborate and percarbonate)
- Monoperoxy sulfate (e.g., Oxone®)
- Organic peroxides
- Peracids

● Reductants

- Sodium thiosulfate $\text{Na}_2\text{S}_2\text{O}_3$
- Sodium sulfite Na_2SO_3
- Sodium hydrosulfite (also called sodium dithionite) $\text{Na}_2\text{S}_2\text{O}_4$

● Photobleaches

- Phthalocyanines

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Formulation Basics

Enzyme Types

- **Proteases**

- Break down protein-based soils
 - Blood
 - Grass
 - Egg
 - Portion of collar soil associated with human skin

- **Amylases**

- Break down starches based on sugars
 - Chocolate
 - Food syrups

- **Lipases**

- Break down fats and oils derived from animals or vegetables
 - Vegetable oils (olive, sunflower, canola, etc.)
 - Fats (butter, margarine, shortening)
 - Certain cosmetics that use such natural oils

- **Cellulases**

- Break down cellulose
 - Remove microfibrils
 - “Polish” fabrics

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Formulation Basics

Adjuvants

- What are they: “all else”
- Functions: enhance cleaning (present and/or future), aesthetics, formulability
- General types
 - ✓ Solvents
 - ✓ Hydrotropes
 - ✓ Polymers
 - ✓ Thickeners
 - ✓ Brighteners (fluorescent whitening agents)
 - ✓ Antimicrobials
 - ✓ Perfumes

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Formulation Basics

Water Types (no, really)

- Municipal
- Softened Municipal
- Softened Deionized (DI)
- Reverse Osmosis (RO)
- Distilled (perhaps multiple passes)

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Green Products – The Next Frontier is at your door

Why isn't everything sustainable yet?

- Products targeted toward “earth friendliness” have been around for decades
 - Generally meant less performance
 - Generally meant higher cost
- Technology was gradually improving, bringing performance and pricing into line with mainstream products
- Clorox followed the progress of emerging technology:
 - Convergence of technology and a growing consumer demand
 - Formulation know-how allowed Clorox researchers to propose improvements over current eco-products
 - Not simply swap-outs of “green” ingredients: faith that ground-up formulation building would provide new insights

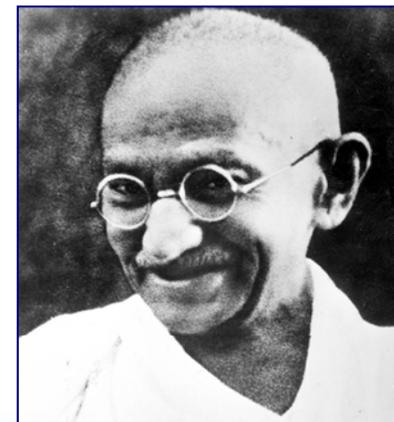
Green Products – The Next Frontier is at your door

Then, suddenly, everything seemed to converge:

- “An Inconvenient Truth” brought sustainability to the center of the radar screen – June 2006
- Wal*Mart sustainability initiative, with its “trickle down” to their vendors, will accelerate the progress of the category (c.f., phosphates, NTA, APEs, etc.) – November 2006

“Gandhism” is coming true:

“First they ignore you, then they laugh at you, then they fight you, then you win.”



Green Products – The Next Frontier is at your door

Infrastructure is relatively new

- Programs developed in the U.S. directly involve suppliers, producers, non-governmental groups, and the EPA
 - Design for Environment
 - GreenBlue
 - Green Seal
 - Natural Products Association
- Increased connection to NGOs, influencers, e.g., Sierra Club maintain focus
- Economic factors are going to play an increasingly important role, possibly outpacing consumer demand
- Some technologies are lagging (e.g., biodegradable packaging), but are emerging



Green Products – The Next Frontier is at your door

Priorities of the new framework are subjective

- What are the major issues?
 - Source of chemicals: chemicals from renewable resources, (which comes down to oleochemicals versus petrochemicals); preference for plant- versus animal-based basis
 - Toxicity: are the products/chemicals minimally toxic to humans; are the products/chemicals minimally toxic to animals; are the products/chemicals minimally toxic to aquatic species (minnows, fish, algae)?
 - Biodegradability: are the products/chemicals ultimately biodegradable; are the products/chemicals readily biodegradable; are the biodegradation products bio-inert?

Green Products – The Next Frontier is at your door

Priorities of the new framework are subjective

- What are the *other* major issues?
 - Avoidance of antimicrobials: misguided belief that they lead to resistant microbes; belief of inherent toxicity; extension to preservatives
 - Avoidance of dyestuffs: artificial colorants; fluorescent whitening agents (brighteners)
 - Avoidance of fragrances: sensitization, allergies
 - Potential avoidance of enzymes (extreme case): sensitization, allergies; production using genetically modified organisms (bacteria, yeast) that are never present in the raw material itself!

Green Products – What Is The (New) Truth?

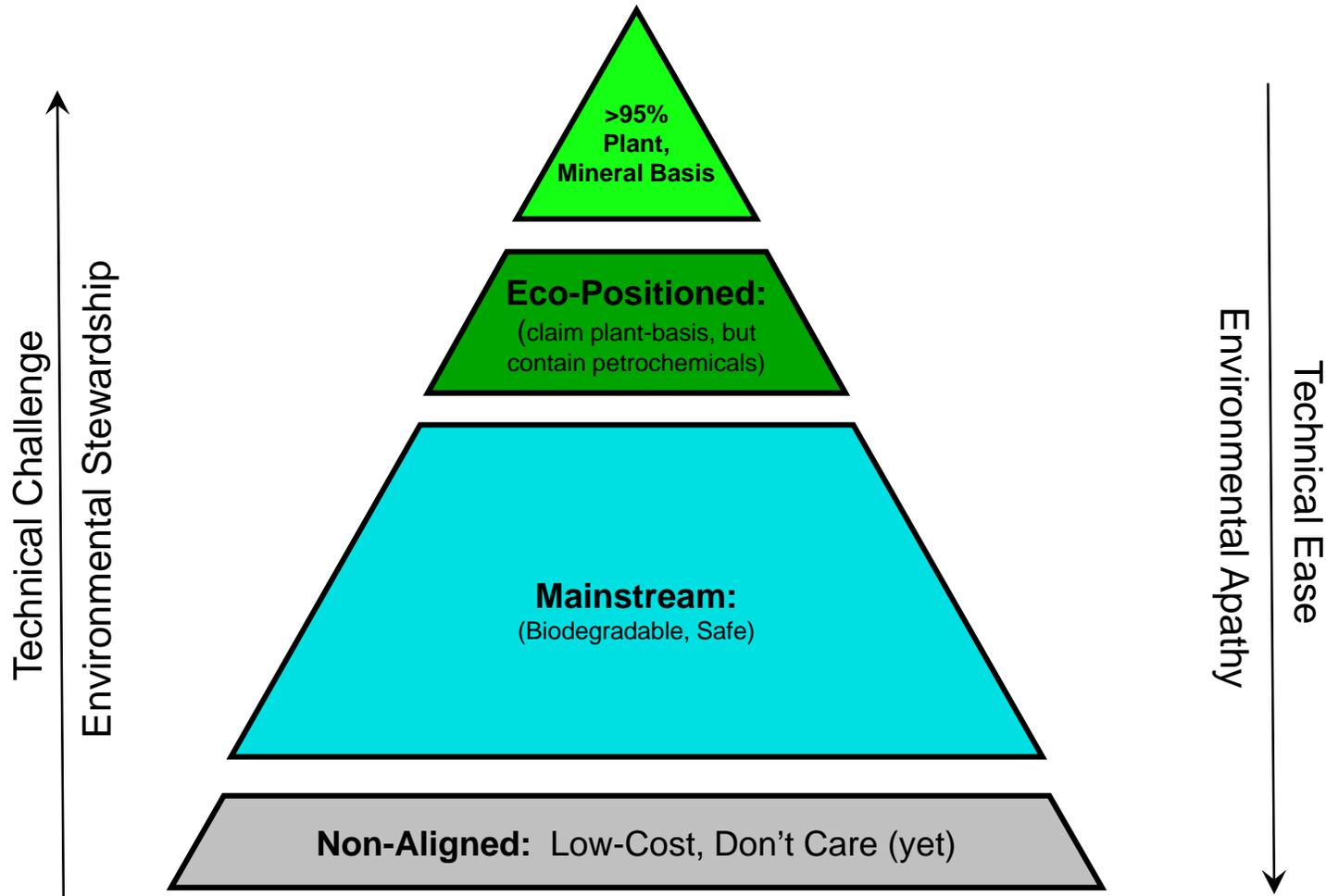
Companies are just now solidifying their strategies

- Some are further along than others
 - Is it just the use of oleochemicals, or is it the entire carbon footprint?
 - Is it the bottle, or what goes into the bottle?
 - Is it just the product – impact of the holistic view of cradle-to-grave (source-to-sewer?)



Green Products – What Is The (New) Truth?

Companies are just now solidifying their strategies



Summary – Welcome to the Tipping Point

- A. The industry is quickly coming to the last stage of Ghandiism
- B. The new paradigm of giving consumers good performance at a good price has to take into account “An Inconvenient Truth”: green is here, green is the future
 1. While at the edge of mainstream products, actual formulating leeway is potentially limiting from differentiating standpoint
 2. Lack of raw material choices actually makes one very nimble
 3. Best to take an extreme approach in looking for options, and work your way back to the center (a.k.a., the primary-to-election process)
- C. This is the New Vanguard
 - A. Come in curious
 - B. Come in ambitious
 - C. Aim for the top of the pyramid

