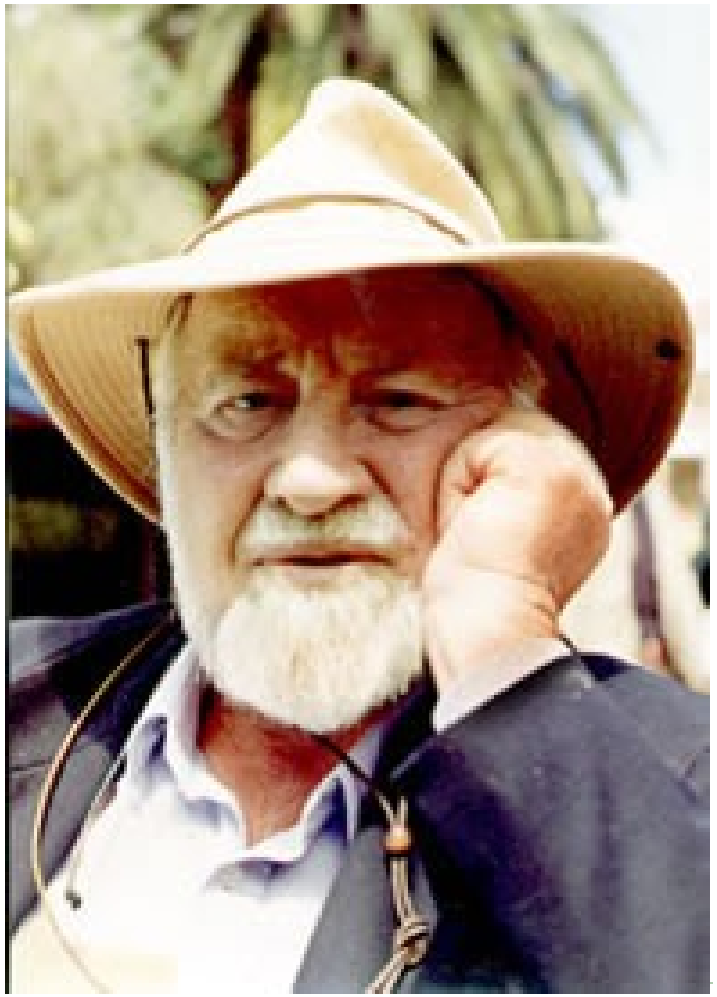
Permaculture

What might it have to offer a green economist?

Definition

- ‘The use of systems thinking and design principles that provide the organising framework for implementing a vision of consciously designed landscapes that mimic the relationships and patterns found in nature’



- ‘Linear relationships are easy to think about: the more the merrier. Linear equations are solvable, which makes them suitable for textbooks. Linear systems have an important modular virtue: you can take them apart and put them together again—the pieces add up.
- Non-linear systems generally cannot be solved and cannot be added together . . . Non-linearity means that the act of playing the game has a way of changing the rules . . . That twisted changeability makes non-linearity hard to calculate, but it also creates rich kinds of behavior that never occure in linear systems’
  - James Gleick, *Chaos: Making a New Science*

Traditional wisdom

- ‘Because of feedback delays within complex systems, by the time a problem becomes apparent it may be unnecessarily difficult to solve’
- Translation: ‘A stitch in time saves nine’
- ‘A diverse system with multiple pathways and redundancies is more stable and less vulnerable to external shock than a uniform system with little diversity’
- Translation: Don’t put all your eggs in one basket

Howard Odum

- Odum developed methods for tracking and measuring the flows of energy and nutrients through complex living systems
- Ways of understanding the links between flows of money and goods in society and the flows of energy in ecosystems
- ‘industrial man . . . eats potatoes largely made of oil’ *Environment, Power and Society*, 1971

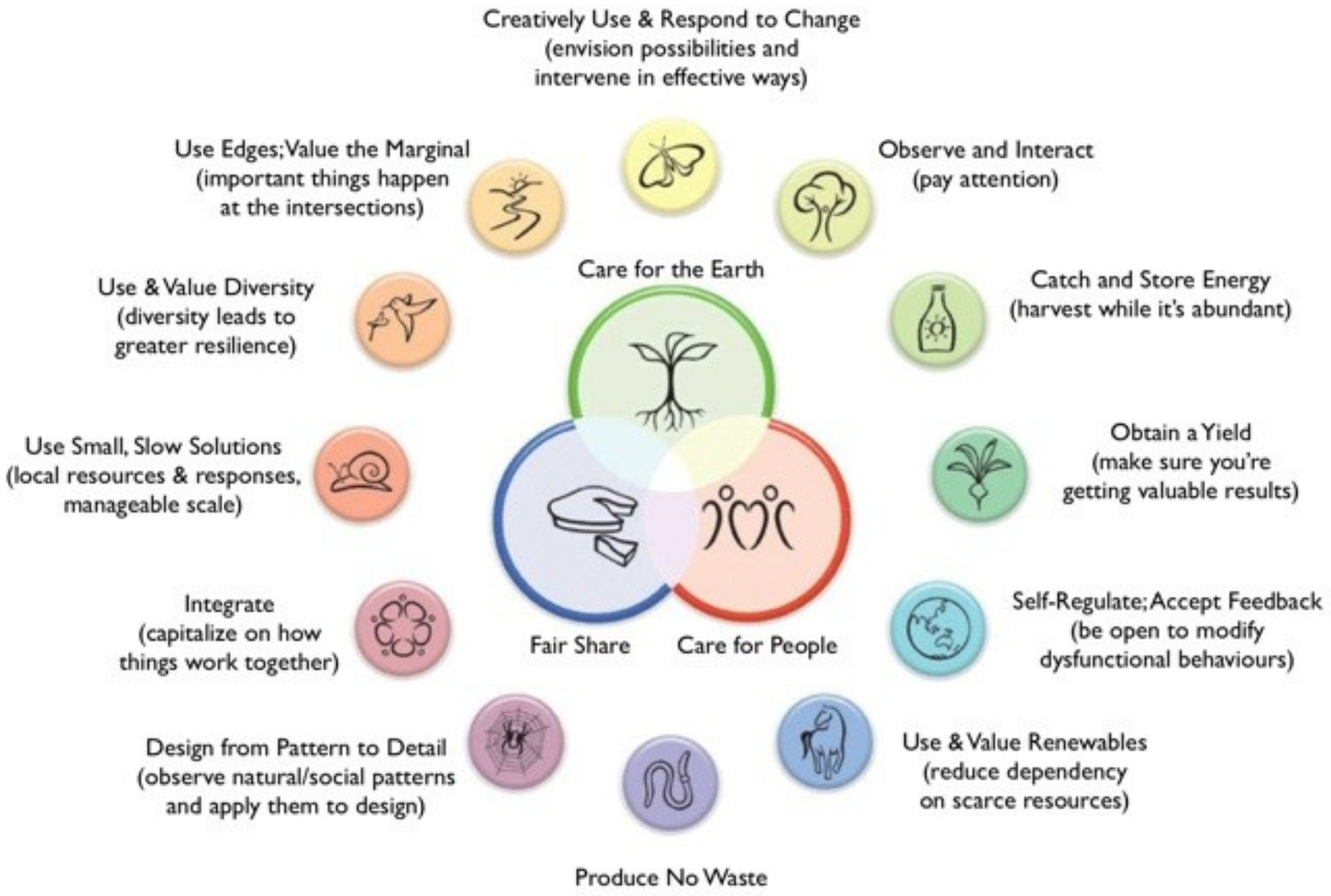
- ‘Odum proposed that a measurement of the amount of transformed solar energy embodied in any product of the biosphere or human society—for which he coined the term ‘emergy’—could provide a kind of ‘universal currency’ which would allow fair and accurate comparison of the human and natural contributions to any particular economic process. This approach was so original that it has still not been fully incorporated into thinking about responses to climate change, where understanding the embodied energy in products is arguably more critical than only considering the direct energy flows in electricity generation or the work of an internal combustion engine.’

  - Steve Harris

A Proto-Transitioner?

- Devised the concept of an ‘energy descent’ in his final book *A Prosperous Way Down* (2001)
- Economic values based on measures of the quantity and quality of embodied solar energy, rather than on monetary worth

- Modern societies have reached the climax of a period of massive growth driven by fossil fuel energy: downturn is now inevitable


Creatively Use & Respond to Change
(envision possibilities and
intervene in effective ways)
Use Edges; Value the Marginal
(important things happen
at the intersections)
Observe and Interact
(pay attention)
Use & Value Diversity
(diversity leads to
greater resilience)
Care for the Earth
Catch and Store Energy
(harvest while it's abundant)
Use Small, Slow Solutions
(local resources & responses,
manageable scale)
Obtain a Yield
(make sure you're
getting valuable results)
Integrate
(capitalize on how
things work together)
Fair Share
Care for People
Self-Regulate; Accept Feedback
(be open to modify
dysfunctional behaviours)
Design from Pattern to Detail
(observe natural/social patterns
and apply them to design)
Use & Value Renewables
(reduce dependency
on scarce resources)
Produce No Waste

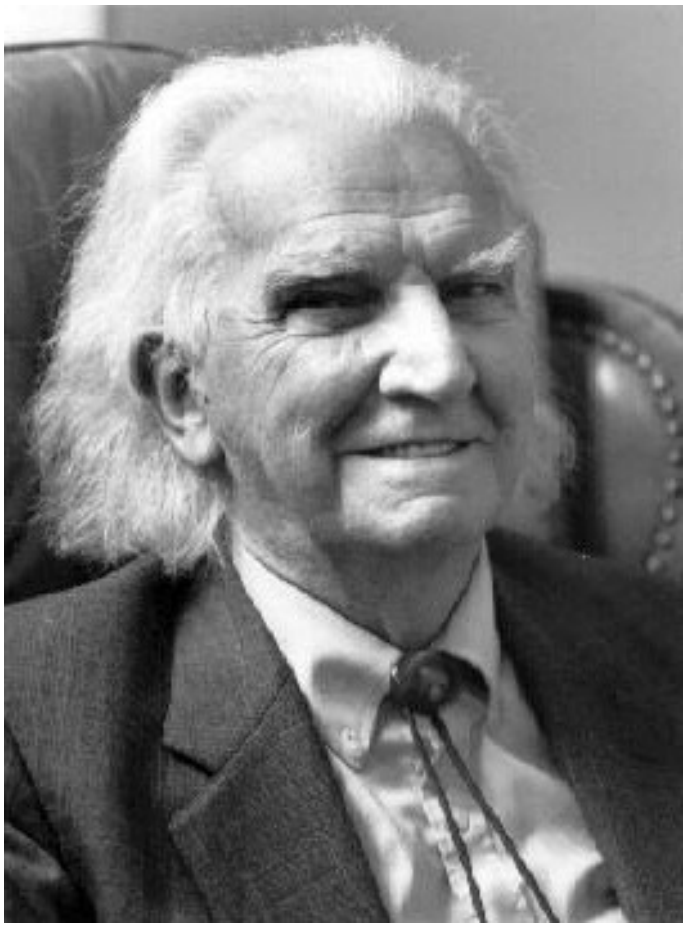
What permaculture says about economics

Finances & Economics

Local and regional currencies
Carpooling, Ride sharing & Car share
Ethical Investment & Fair Trade
Farmers markets & Community Supported Agriculture (CSA)

WWOOFing & similar networks
Tradable Energy Quotas
Life Cycle Analysis & Emergy Accounting

From linear to cyclical economy



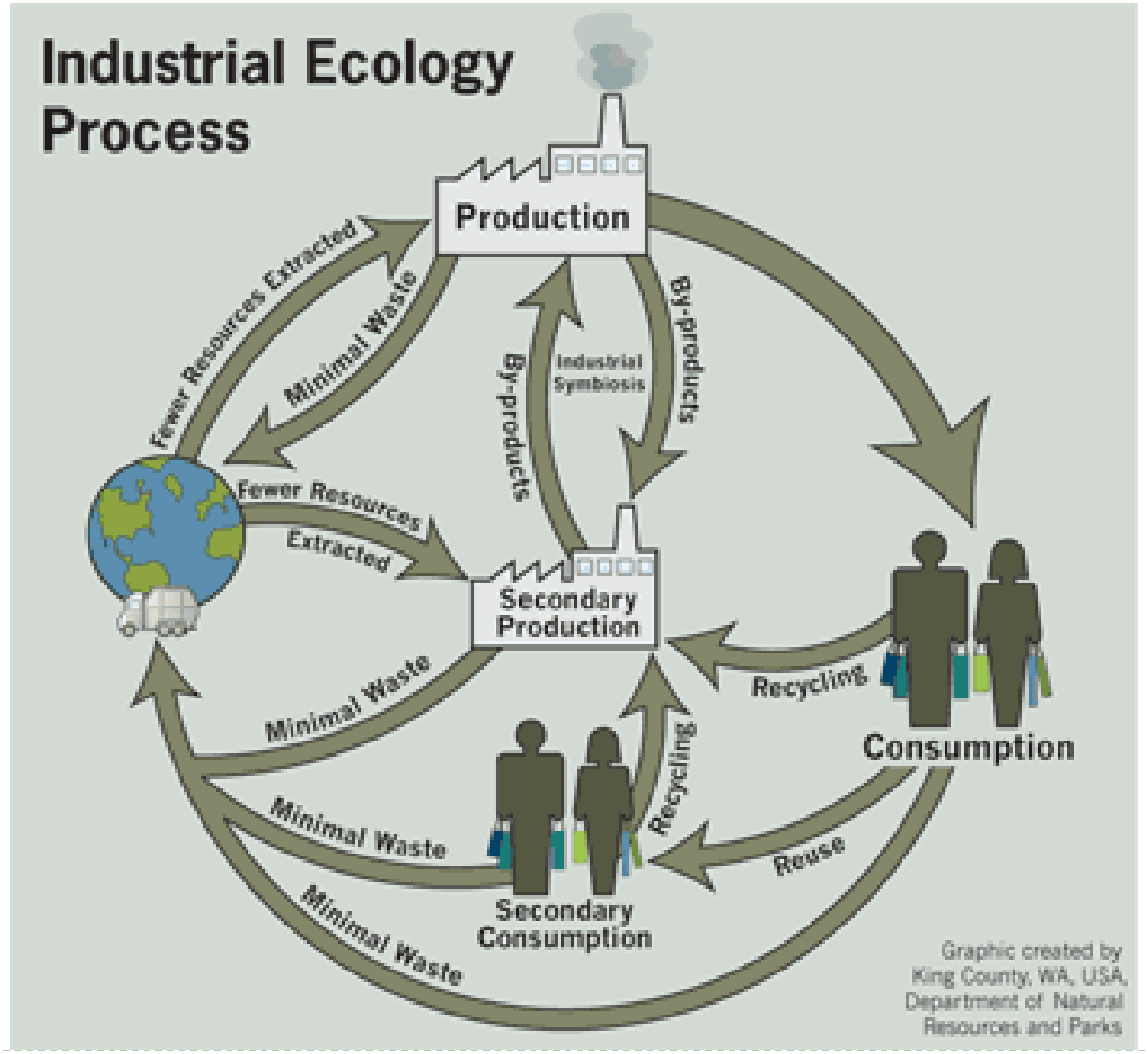
- ‘cannot turn pots back into clay’
- ‘extracts fossil fuels and ores at one end and transforms them into commodities and waste products’
- permaculture

  suggests the need

  to reuse our waste

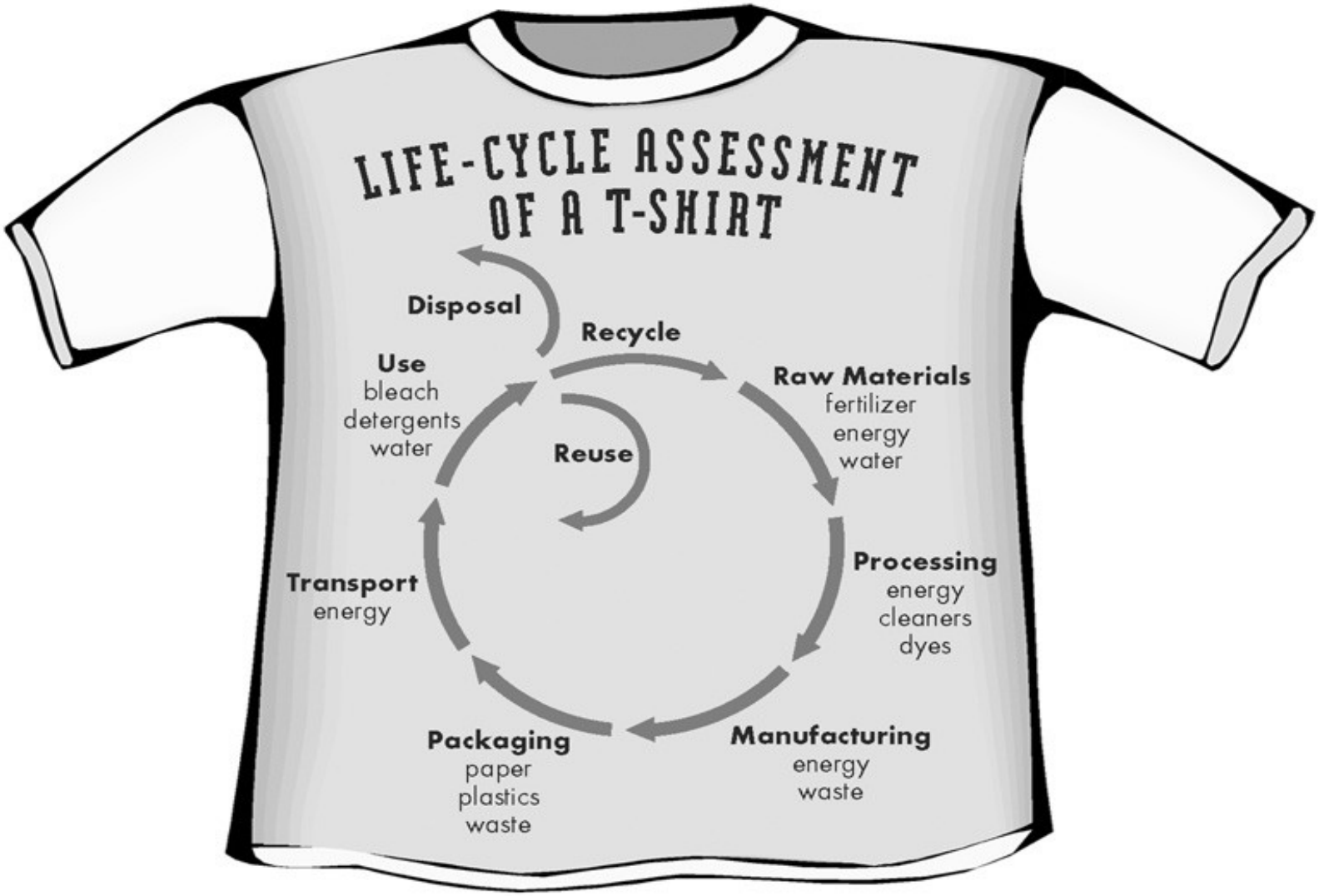
Industrial ecology

- Industrial ecology provides a powerful prism through which to examine the impact of industry and technology and associated changes in society and the economy on the biophysical environment. It examines local, regional and global uses and flows of materials and energy in products, processes, industrial sectors and economies and focuses on the potential role of industry in reducing environmental burdens throughout the product life cycle. (International Society for Industrial Ecology website: http://www.is4ie.org/)


Industrial Ecology Process
Production
Fewer Resources Extracted
Minimal Waste
By-products
Industrial Symbiosis
By-products
Fewer Resources Extracted
Secondary Production
Recycling
Consumption
Minimal Waste
Minimal Waste
Recycling
Reuse
Secondary Consumption
Minimal Waste
Graphic created by King County, WA, USA, Department of Natural Resources and Parks

Life-Cycle Accounting

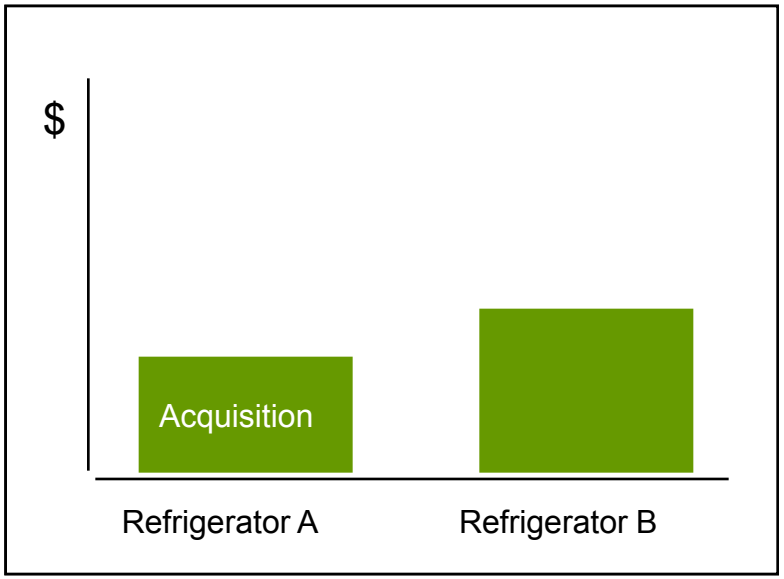
- Applies systems thinking to a production process
- Includes assessments of impacts in the product life-cycle outside the producing company
- All costs and benefits throughout the life-cycle
- ‘cradle to cradle’—but without the assumption for continuing consumption

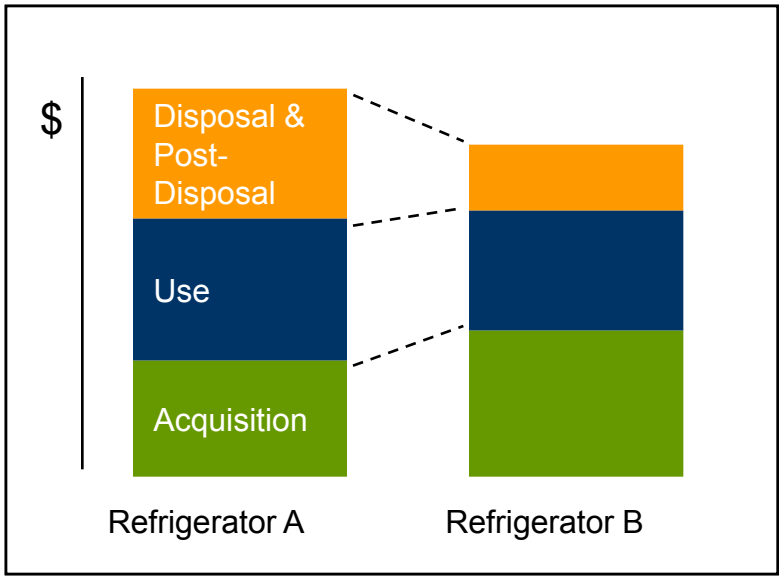

LIFE-CYCLE ASSESSMENT OF A T-SHIRT
Disposal
Recycle
Use
bleach
detergents
water
Raw Materials
fertilizer
energy
water
Reuse
Processing
energy
cleaners
dyes
Transport
energy
Packaging
paper
plastics
waste
Manufacturing
energy
waste

- Products can be evaluated through each stage of their life-cycle:
  - Extraction or acquisition of raw materials
  - Manufacturing and
  - processing
  - Distribution and transport
  - Use and reuse
  - Recycling
  - Disposal

- For each stage, identify inputs of materials and energy received; outputs of useful product and waste emissions
- Find optimal points for improvement – eco-efficiency

Life-cycle consideration of a fridge



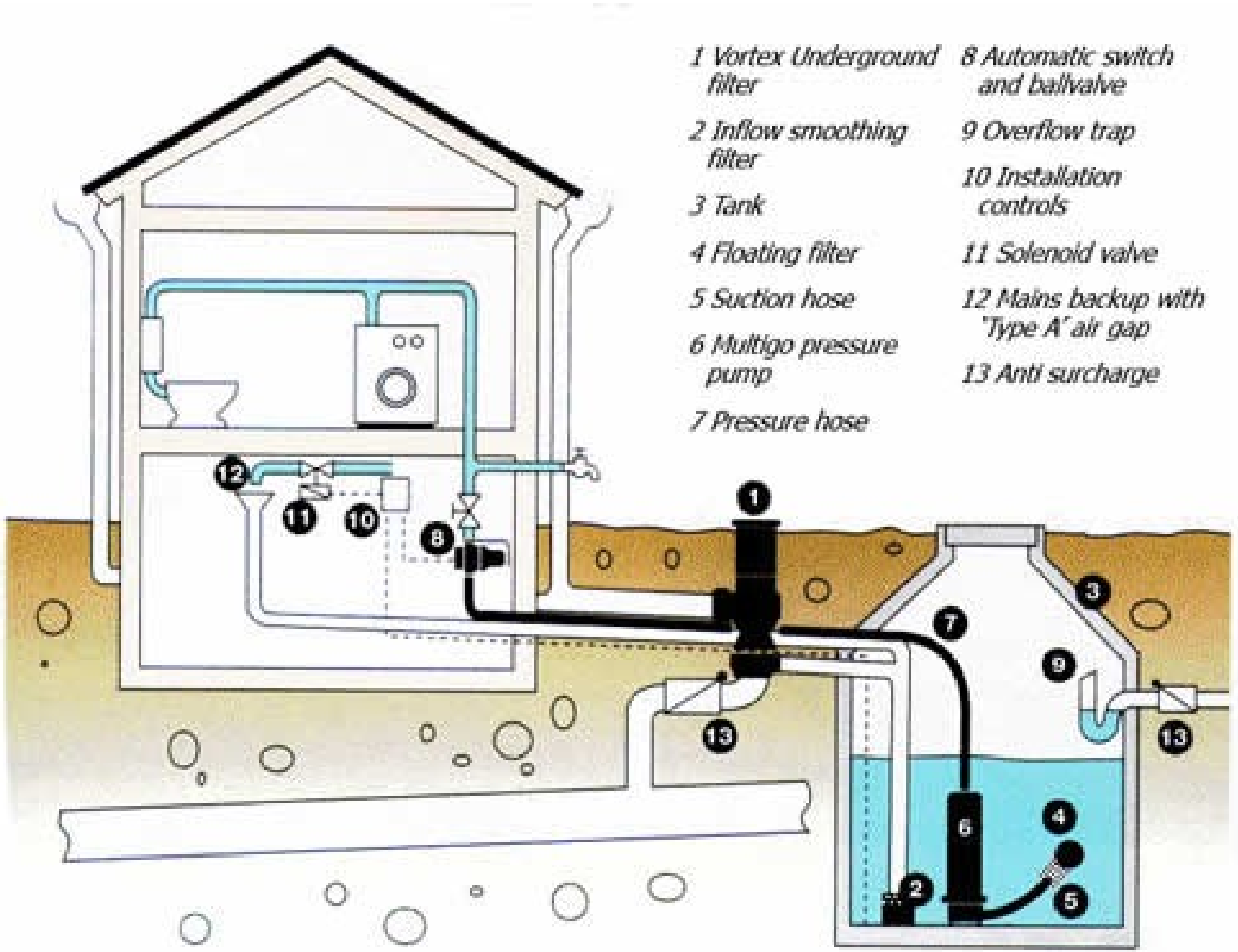


Purchase Price

Refrigerator A appears cheaper

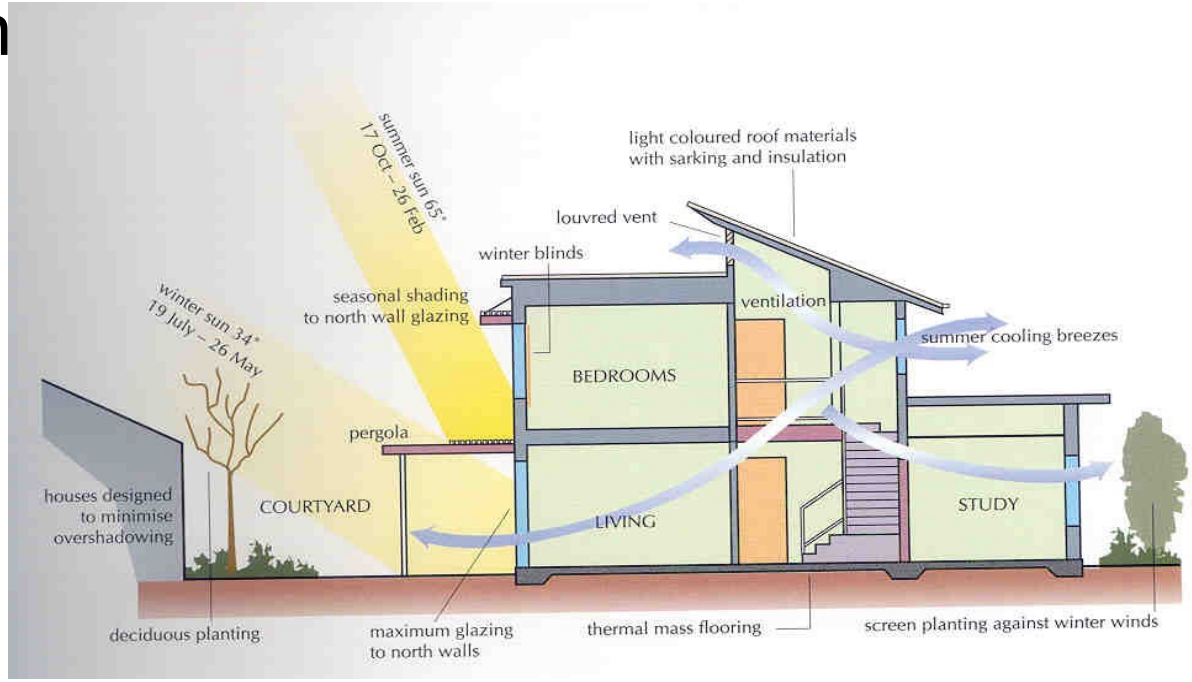
Price + Life-Cycle Costs

Refrigerator B costs less overall


1 Vortex Underground filter
2 Inflow smoothing filter
3 Tank
4 Floating filter
5 Suction hose
6 Multigo pressure pump
7 Pressure hose
8 Automatic switch and ballvalve
9 Overflow trap
10 Installation controls
11 Solenoid valve
12 Mains backup with 'Type A' air gap
13 Anti surcharge

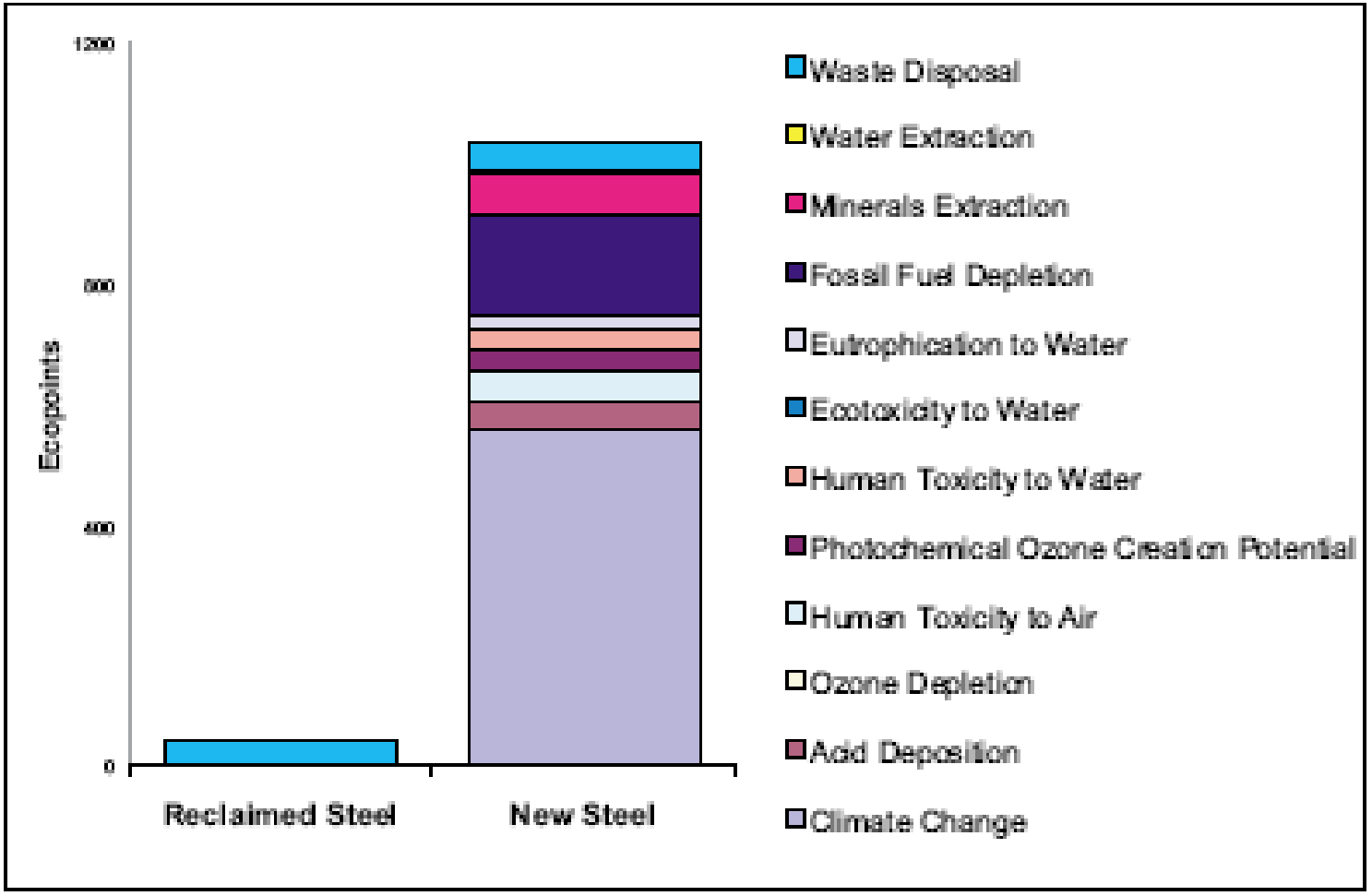
Importance of scale

- Passive design is individual
- Traditional design used the principles ‘wrap up warm and face south’



- How can a mass-market constructor follow this?

Case-study: reclaimed steel



Regional Emergy Intensities

Table 3. Solar transformities of selected fuels and biofuels.
(values also include the emergy associated to labor and services)

Fuel	Transformity (sej/J)	Reference
Coal	6.70E+04	Odum et al., 2000
Natural Gas	8.04E+04	Odum et al., 2000
Crude oil	9.05E+04	Odum et al., 2000
Refined fuels (gasoline, diesel, etc)	1.11E+05	Odum et al., 2000
Hydrogen from water electrolysis (°)	1.39E+05	Brown and Ulgiati, 2004
Hydrogen from steam reforming of natural gas	1.93E+05	Raugei et al, 2005
Hydrogen from water electrolysis (*)	4.04E+05	Brown and Ulgiati, 2004
Methanol from wood	2.66E+05	Giampietro & Ulgiati, 2005
Bioethanol from corn	1.89E+05	Giampietro & Ulgiati, 2005
Ethanol from sugarcane	1.86E+05 - 3.15E+05	Ulgiati, 1997
Biodiesel	2.31E+05	Giampietro & Ulgiati, 2005
Electricity from renewables (§)	1.10E+05 - 1.12E+05	Brown and Ulgiati, 2004
Electricity from fuel cells	2.18E+05-2.68E+05	Raugei et al, 2005
Electricity from thermal plants (#)	3.35E+05-3.54E+05	Brown and Ulgiati, 2004

Agricultural Emergy Intensities

Table 5. Emergy intensities for some common products (after Odum, 1996)

Item	Transformity (Sej/J)	Specific Emergy (Sej/g)
Corn stalks	6.6 E4	
Rice, high energy [1]	7.4 E4	1.4 E9
Cotton	1.4 E5	
Sugar (sugar cane) [2]	1.5 E5	
Corn	1.6 E5	2.4 E9
Butter	2.2 E6	
Ammonia fertilizer	3.1 E6	
Mutton	5.7 E6	
Silk	6.7 E6	
Wool	7.4 E6	
Phosphate fertilizer	1.7 E7	
Shrimp (aquaculture)	2.2 E7	
Steel [2]	8.7 E7	7.8 E9

1. After Brown and McKlanahan, (1996)
2. After Odum and Odum (1983)

Use small and slow solutions - Small and slow systems are easier to maintain than big ones, making better use of local resources and producing more sustainable outcomes

- Stroud pound vs. Lewes pound
- Media and the importance of large
- ‘Is it working?’

Integrate rather than segregate - By putting the right things in the right place, relationships develop between them and they work together to support each other

- Companion planting
- Cottage industry?
- Synergy between different transition projects?
- Local production, local currency, local markets

Design from patterns to details - By stepping back, we can observe patterns in nature and society. These can form the backbone of our designs, with the details filled in as we go

- Can we use these principles in urban design?
- What about Abu Dhabi?
- What about Curitiba?

Use edges and value the marginal - The interface between things is where the most interesting events take place. These are often the most valuable, diverse and productive elements in the system

- Concept of liminality
- Creole cultures and music
- Guerrilla gardening
- Alternatives within capitalism, such as mutualism

- Choose three of the principles
- Think how you might apply them to an economic system or process to make it more sustainable