Beyond Low-Hanging Fruit: The Technical and Business Case for Greenhouse Gas Management

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Rocky Mountain Institute

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- Rocky Mountain Institute is an independent, nonpartisan, market-oriented, technology friendly, entrepreneurial nonprofit organization.

- Since 1982, RMI has worked with corporations, governments, communities, and citizens to help them solve problems, gain competitive advantage, increase profits, and create wealth through the more productive use of resources.

Energy systems start with hot showers and cold beer*

*...unless you’re English...

Our Goal: Doubled Efficiency in System Design

Autos: 70%, Trucks: 50%, Planes: 30%, Industry: 40%, Buildings: 60%

Ultra-Light Hybrid Vehicles=
low drag, better aerodynamics,
improved engine efficiency

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High-efficiency buildings that
produce net energy with readily
available technologies

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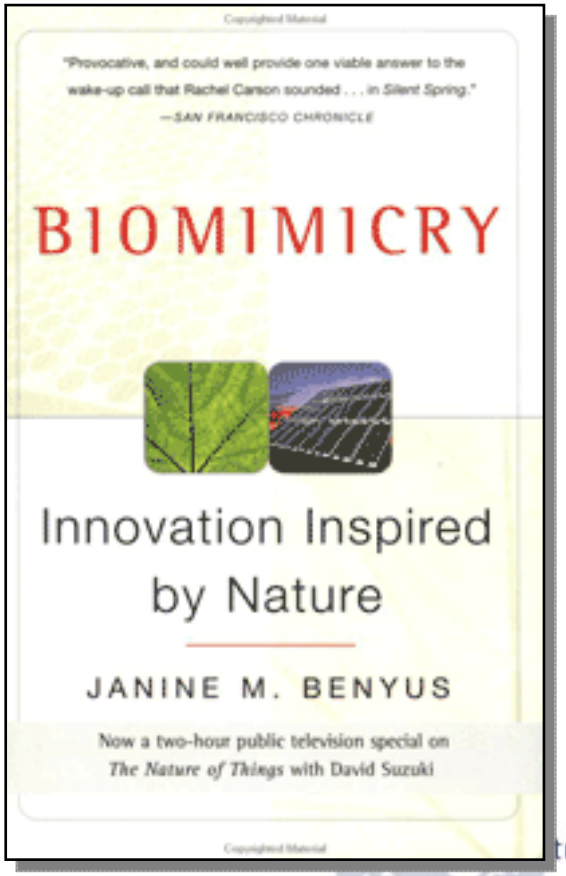
What is Biomimicry?

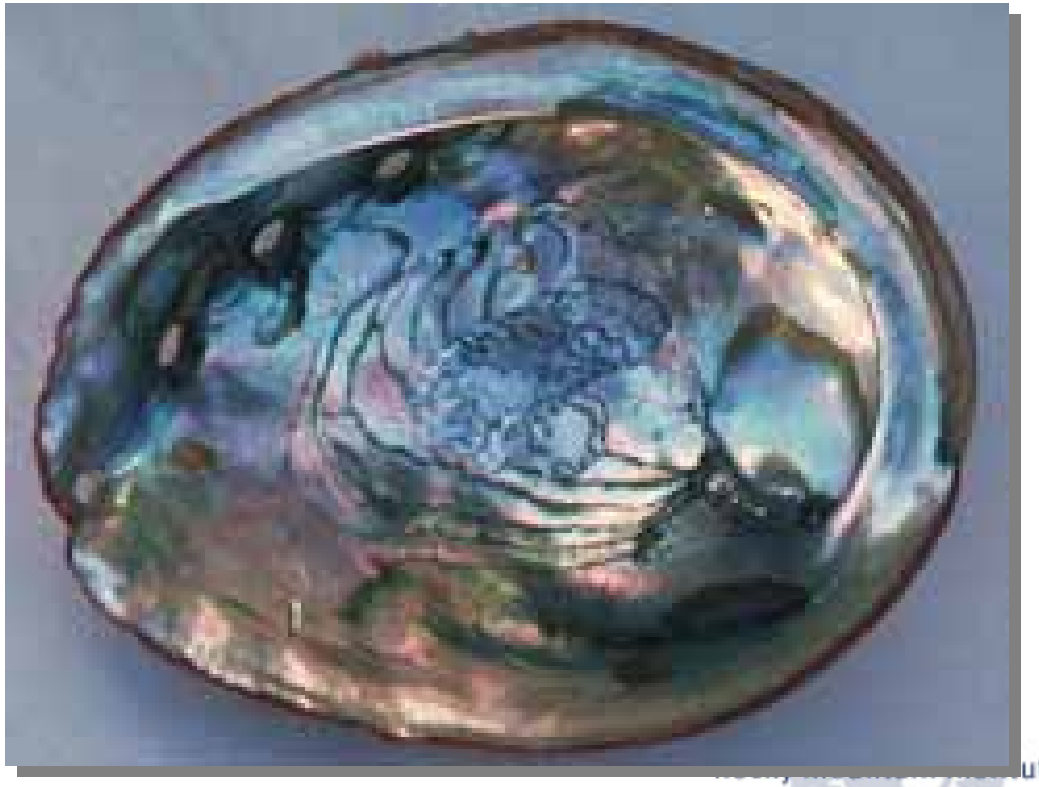
- Nature as Model
  - Biomimicry studies nature's models and imitates designs and processes to solve human problems
- Nature as Mentor
  - Biomimicry is a new way of viewing and valuing nature
  - Asks what we can learn, not what we can extract from the natural world.
- Nature as Measure
  - Biomimicry uses an ecological standard to judge our innovations

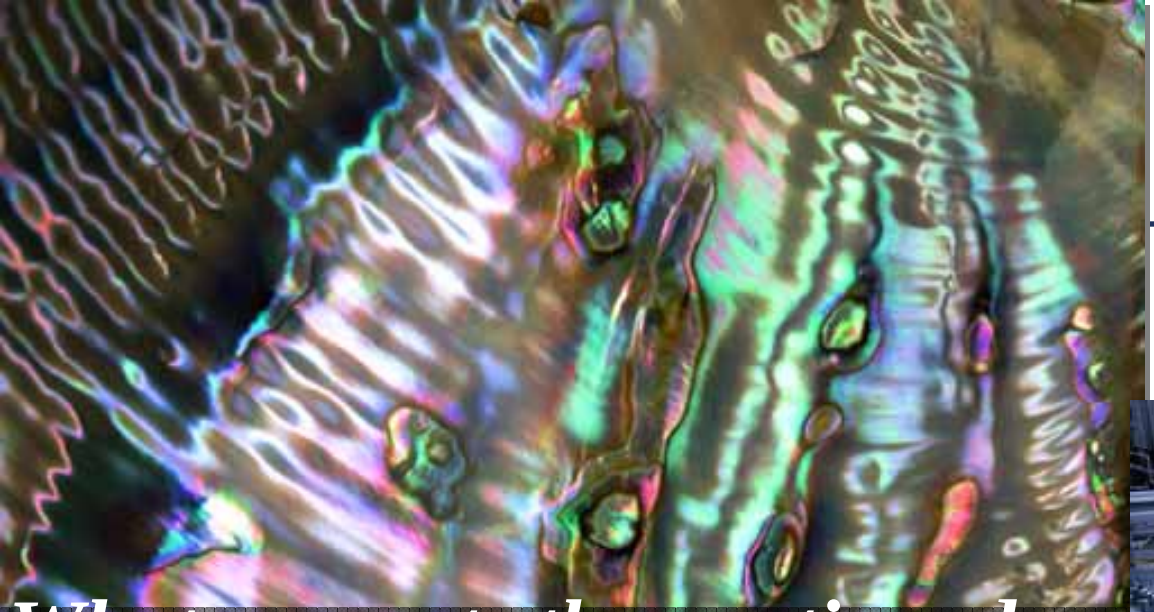


Process

How is it made?

- Abalone nacre
- Twice as tough as man-made high-tech ceramics
- Abalone excretes proteins that assemble an electrically charged framework on which seawater deposits minerals, forming a crystalline inner shell
- Formed in seawater at 4˚C
- Zero waste





What prevents the continued mineralization of the abalone shell?

Where else might it come in handy to stop mineralization?

Industrial Symbiosis Kalundborg, Denmark

- Mutually beneficial exchange of material and energy between individual firms located in close proximity
- “..a cooperation between different industries by which the presence of each...increases the viability of the others, and by which the demands of society for resource savings and environmental protection are considered.” *- a Kalundborg manager*
- Original motivation behind most of the exchanges was to reduce costs by seeking income-producing uses for "waste" products.
- By working together:
  - $12 - $15 million saved annually
  - 2.9 million tonnes of waste is exchanged annually
  - Water consumption is reduced by 25%
  - 5000 homes receive district heat

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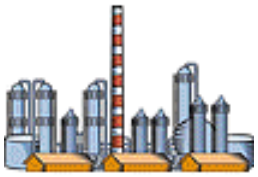
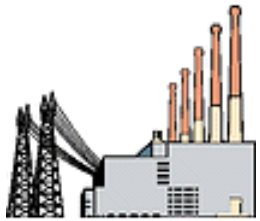
Kalundborg, Denmark



Statoil Refinery

Gyproc



Asnaes Power Plant

City of Kalundborg

Novo Nordisk

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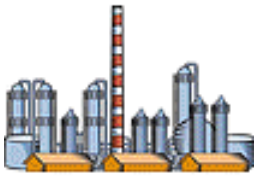
Kalundborg, Denmark



Statoil Refinery

Fuel Gas

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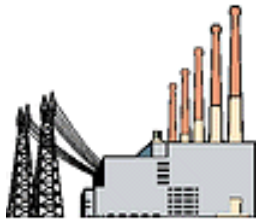

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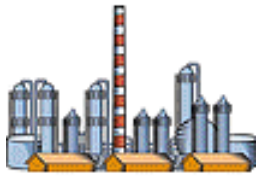

Statoil Refinery

Fuel Gas

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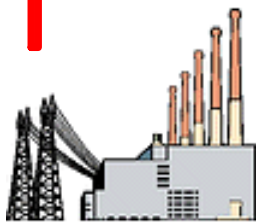
Steam



Waste heat

Asnaes Power Plant

City of Kalundborg

Steam

Novo Nordisk

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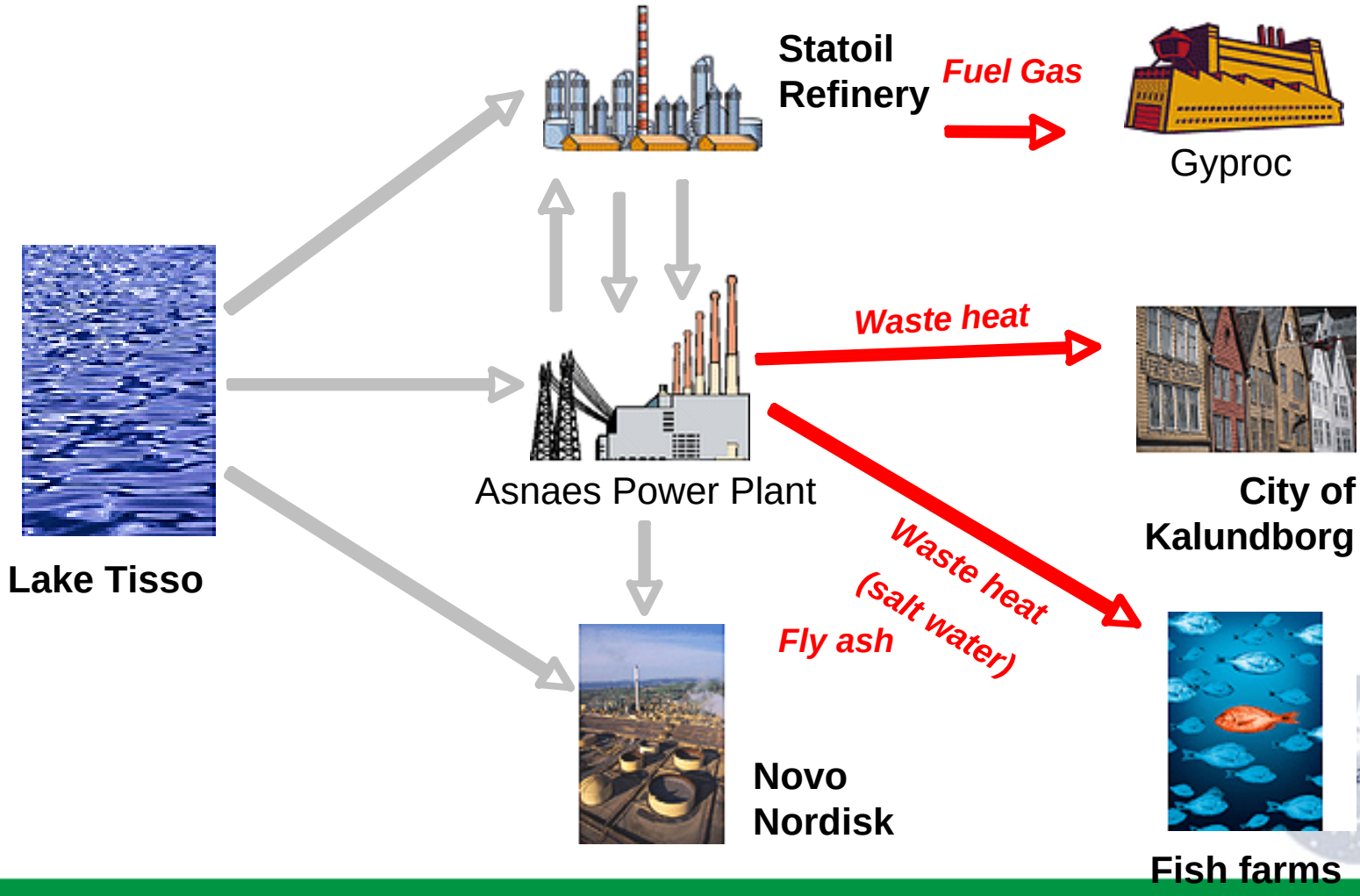
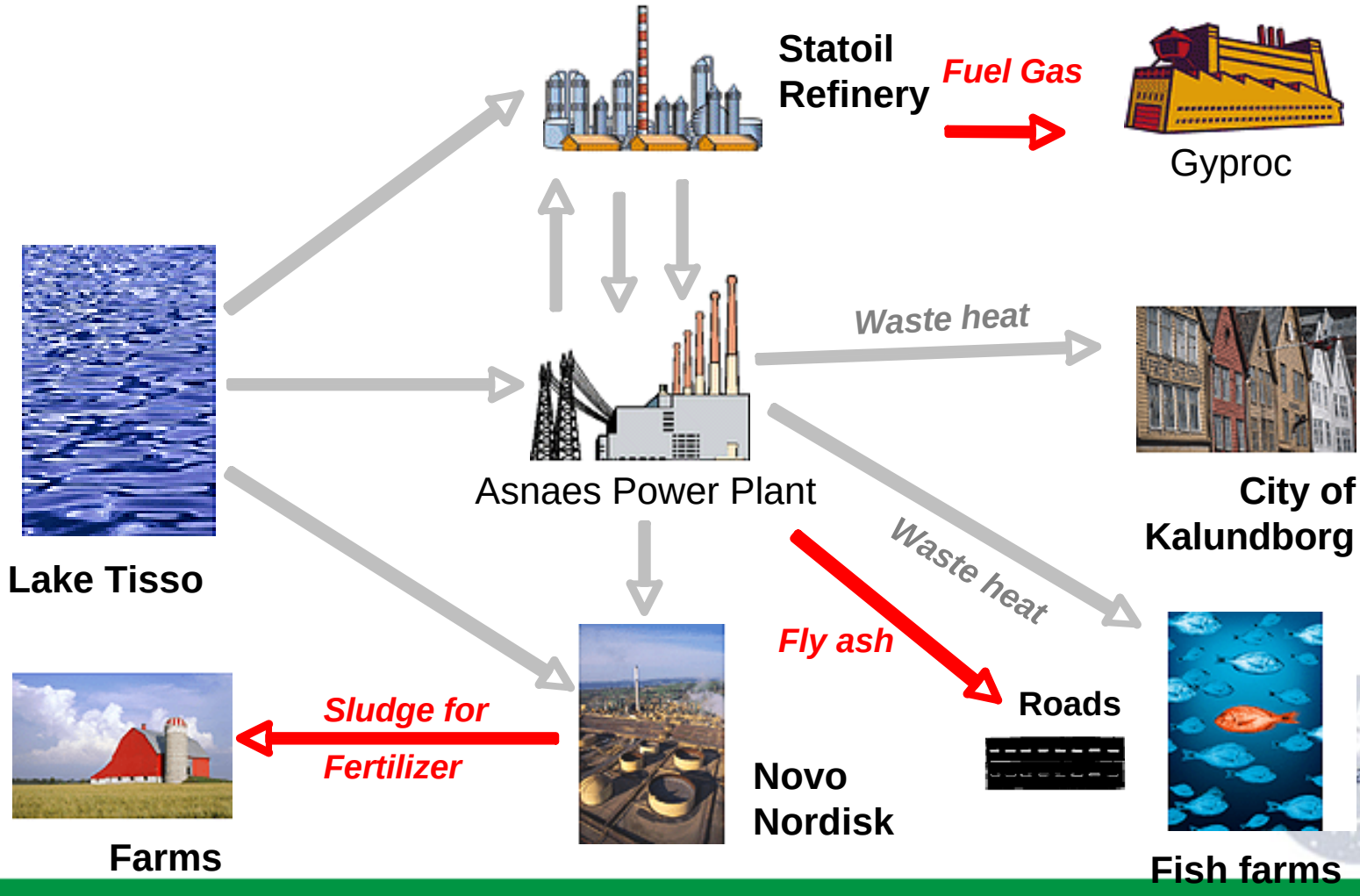


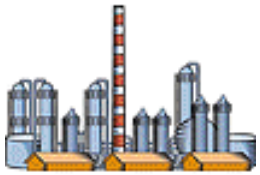
Kalundborg, Denmark



Kalundborg, Denmark

Kemira Acid Plant

Sulphur



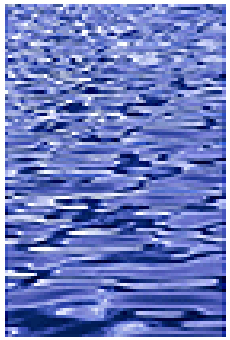
Statoil Refinery

Fuel Gas

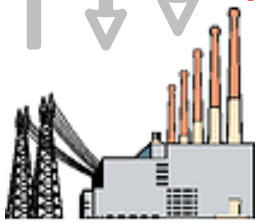
Gypsum

Gyproc

Scrubber sludge



Lake Tisso



Asnaes Power Plant

Waste heat

City of Kalundborg

Waste heat

Fly ash

Novo Nordisk

Roads

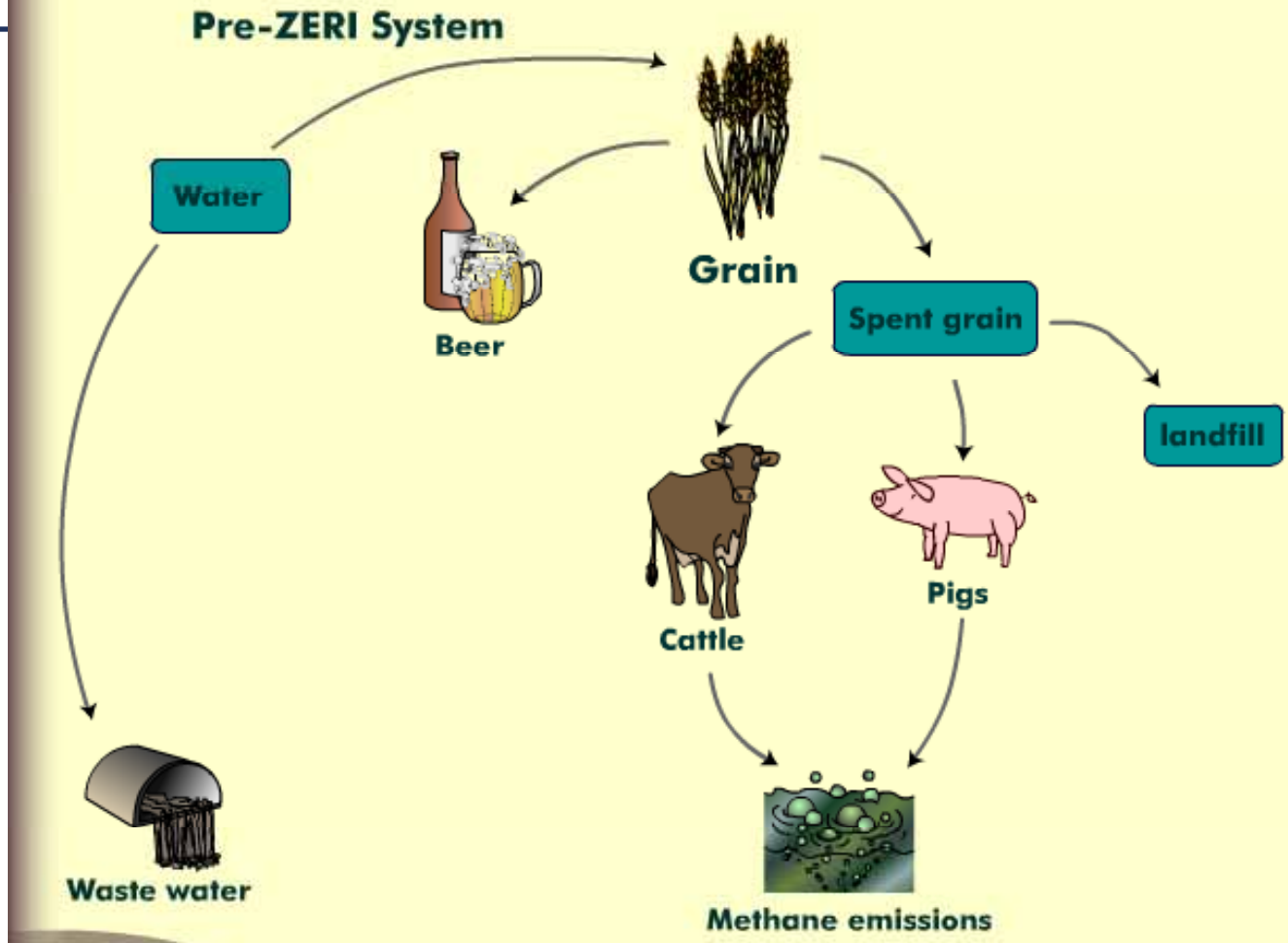
Farms

Yeast for pigs

Fish farms

Fish waste

Beer bakes bread and feeds fish



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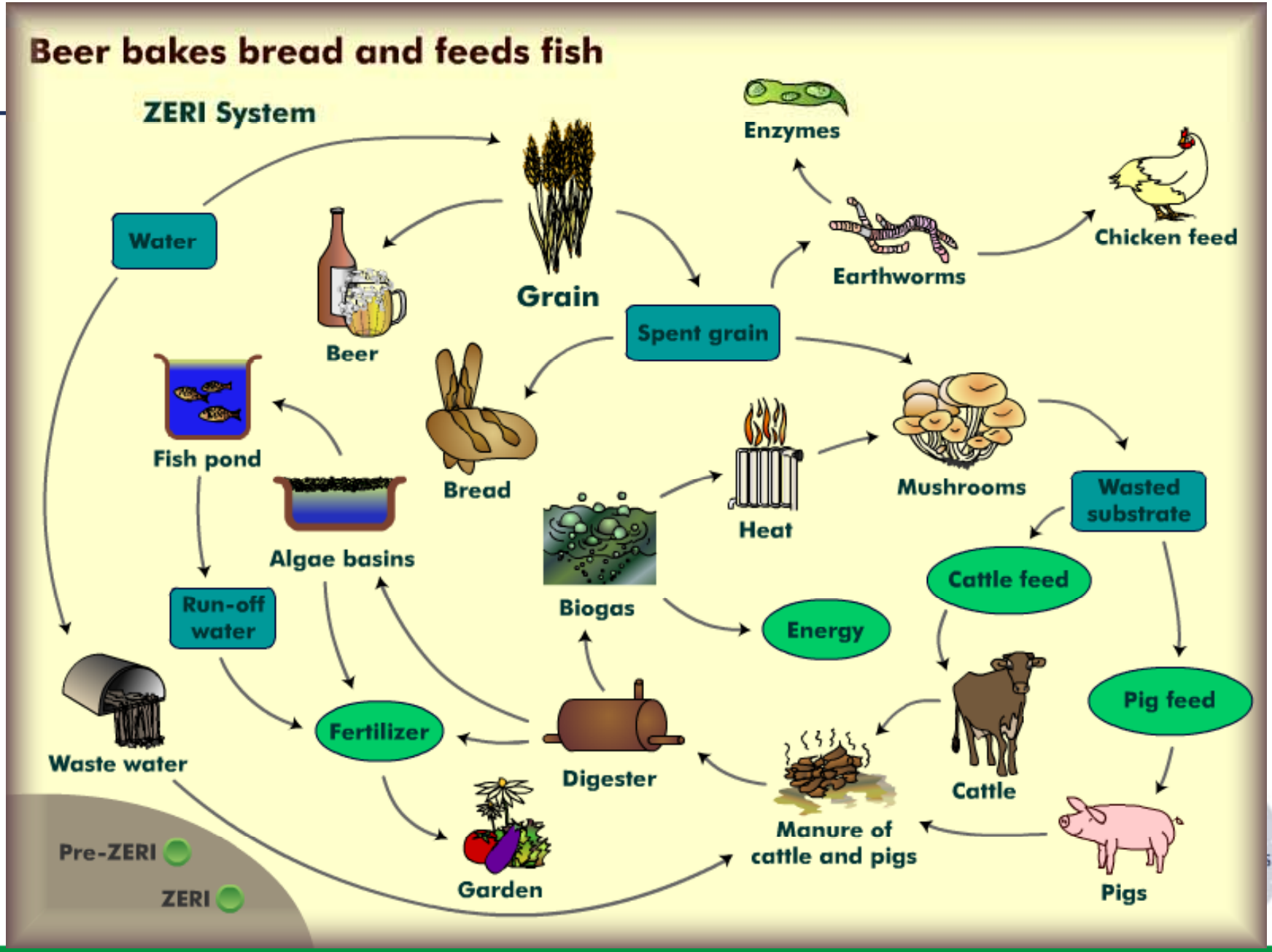

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The Basic GHG Management Toolkit:

- Develop an emissions **inventory** and **baseline**
- Select a **framework for tracking** emissions reductions progress
- **Get the low-hanging fruit**!
  - Implement all cost-effective **in-house GHG reductions** via energy efficiency, CH_4 conversion, etc.
- Clearly **communicate progress** to the public, investors and employees

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Carbon Market Toolkit: First Steps

Information and Documentation	Emission Footprint Reduction
• Emission Accounting, Inventory and Auditing • Model Internal GHG Drivers and Baselines • Set Reduction Goals • Document Reductions Achieved (early action) • Emission Registry • C Market Screening	1. No-Regrets Reductions! - Cost effective energy-efficiency opportunities 2. Clean Energy Supply Development/Purchase - Minimize cost premium 3. GHG Offset Purchase - If cheaper than direct reductions

Carbon Market Toolkit: Longer-term Measures

Continue…

- No-Regrets Reductions
  - Cost effective energy-efficiency, renewable and distributed energy opportunities *still* available.
- Clean Energy Supply
  - Development of renewable resources and/or purchase of green power or RECs
- Carbon Offset Acquisitions
  - Continue to purchase carbon offsets to reduce a firm's emission liability and the need to implement expensive reduction measures.

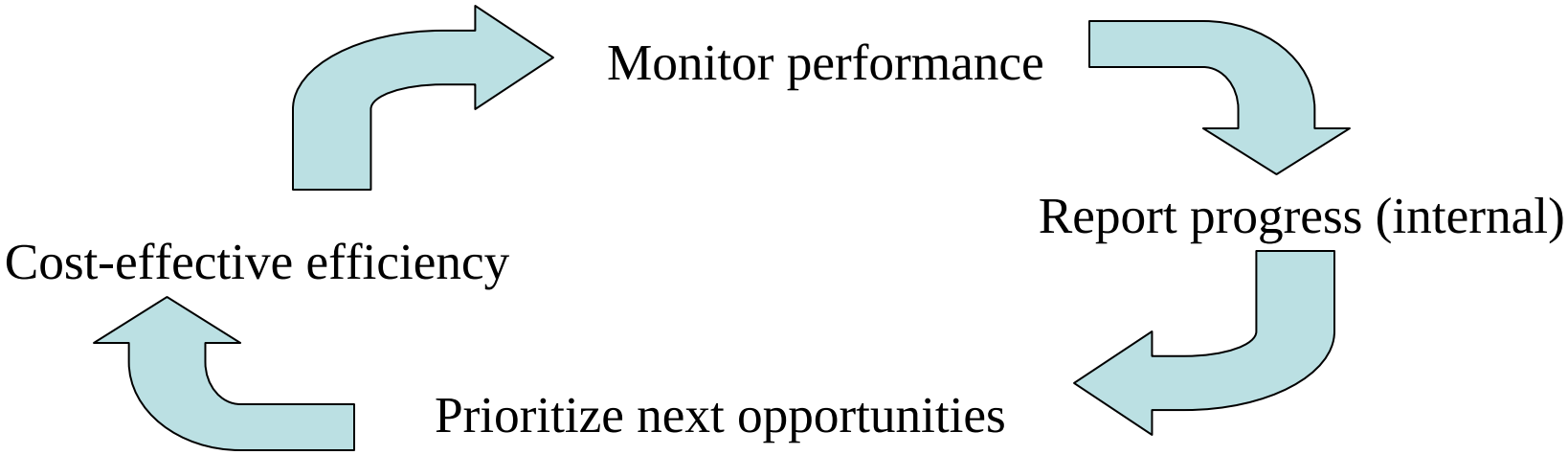
Then…

- New Products and Services
  - Products (e.g., carbon-neutral floor covering, renewable biofuels);
  - Services (e.g., energy efficient design, carbon trading); and
  - Energy technology (e.g., fuel cells, advanced renewables, cellulosic biofuel conversion)
  - Enabling technology (e.g., lightweight materials, advanced power electronics, lithium ion batteries)

Bottom Line: How a company manages energy and emissions will impact value

- Implementing energy efficiency programs will increase profits while meeting climate targets
- First 15–20% energy savings are often NPV positive — our experience says 30–40% are often possible, so meeting Kyoto targets may be zero or low cost for many firms, especially if sector growth is modest
- Cost-effective efficiency and low-cost renewable energy provide a hedge value for volatile and increasing prices of electricity and fuel (and GHGs)
- Moreover, in a carbon constrained world, we expect new and growing markets to emerge for low-carbon products, services and technology

Efficiency and sustainability can be a virtuous circle



The incremental approach:
The rate of progress depends on "cost-effectiveness" criteria…

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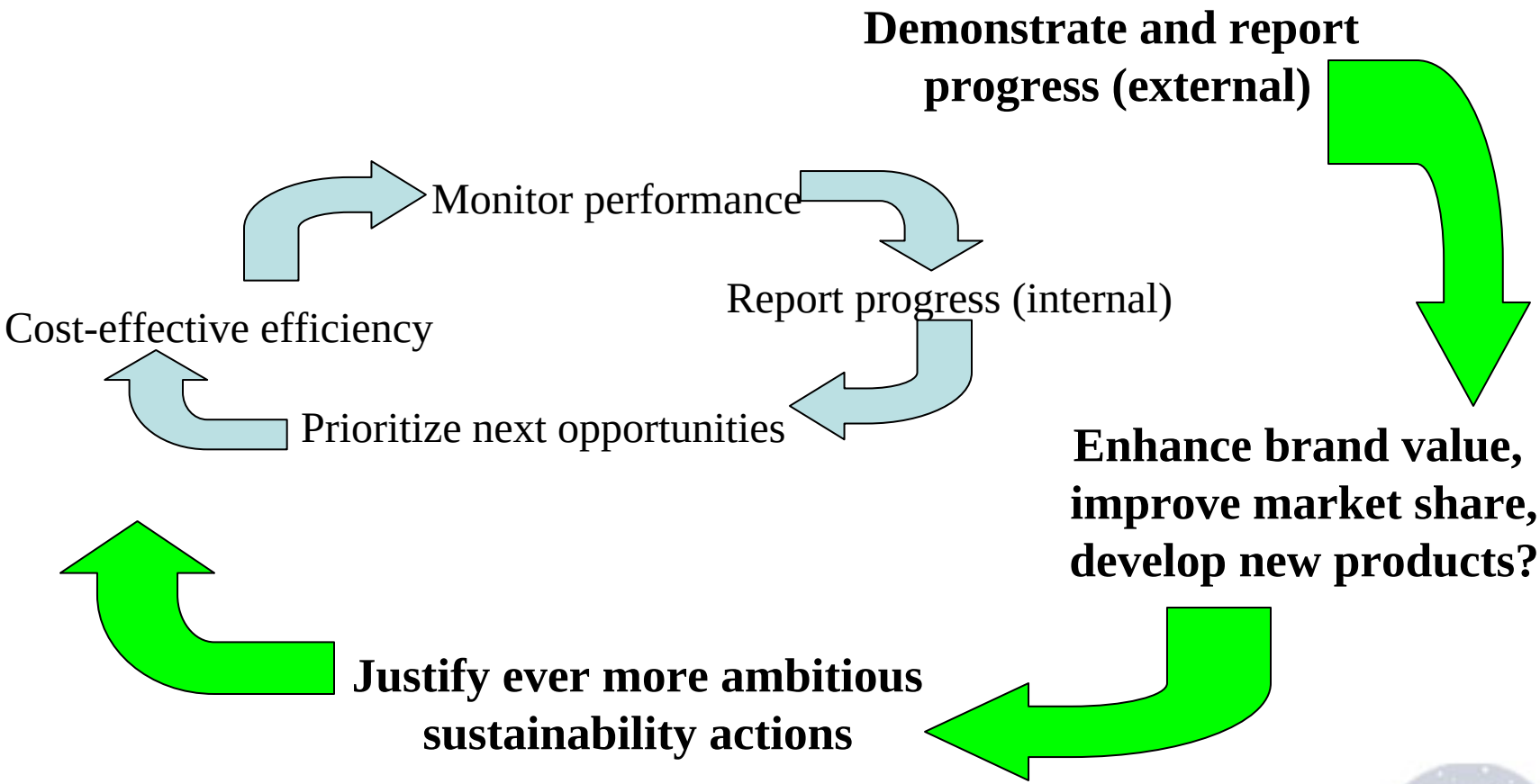
But there is another, more powerful virtuous circle…



A revolutionary approach:
How do we measure, compare "top-line" metrics?

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America's Post-Kyoto Carbon Tax

- The U.S. withdrew from the Kyoto Protocol committing signatories to greenhouse gas (GHG) reductions by the 2008-2012 period
- The action was justified by studies showing that U.S. compliance with Kyoto would require a carbon tax as high as $50/ton-$CO_2$
- Since then, the wholesale price of gasoline has climbed by about $0.65-1.30/gallon, and that of natural gas by over $4-8/MMBtu
- These price premiums are equivalent to a carbon tax of $80-160/ton-$CO_2$

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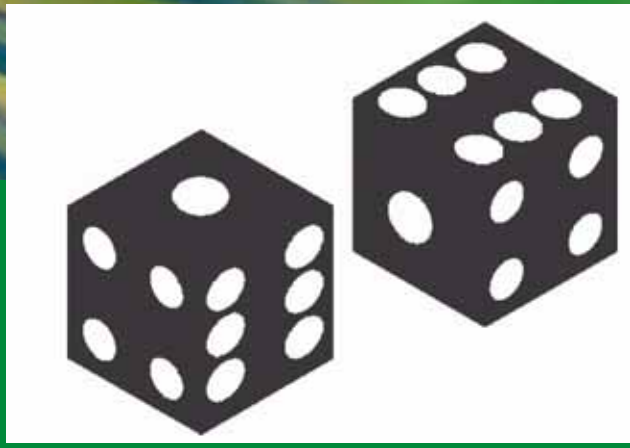
Popular reporting on climate change uncertainty

What we hear is like flipping a coin, 50/50:

"There is uncertainty about climate change, so maybe it exists, maybe it doesn't," WRONG!

The truth is more like rolling two dice:

- The most likely result is 6, 7, or 8 - this is the consensus view that climate change has begun
- There's a small chance of 2 or 3 - this is the complacent view of moderating climate change
- There's also a small chance of 11 or 12 - this is the alarming view of sudden climate change



Uncertainty remains about the magnitude, geographic distribution and timing of climate change, but the argument is no longer about whether climate is changing or whether human emissions are responsible.