Natural Capitalism

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CAPITALISM:

The productive use of and reinvestment in capital.
But what is capital?

- **Money**—financial capital
- **Goods**—physical or manufactured capital: buildings and equipment
- **People**—human capital: culture and community
- **Nature**—natural capital: natural resources and ecosystem services
Without natural capital there is no life and therefore no economic activity

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Valuing Nature: Insurance Example
Biosphere II

$200,000,000 and...

...no air
First Industrial Revolution

Theory: People are scarce and nature is abundant—to increase labor productivity.

Result: productivity increase of 100X
Next Industrial Revolution

People are abundant and nature is scarce—increase resource productivity.
The limits to future profits are...

...fish...

...not boats
Next Industrial Revolution

4X, 10X, even 100X as much benefit…

…from each unit of resources.
“People who seem to have had a new idea have often just stopped having an old idea”
Four principles of natural capitalism

P1: Radically increase resource productivity

P2: Biomimicry: closed loops, no waste, no toxicity

P3: Shift to a solutions based economy: from product to service

P4: Reinvest in natural and human capital
P1: Radically increase resource productivity

Do more, better, with less, for longer
What is radical resource efficiency?

- Save 25,000,000 gallons per year at a manufacturing plant
- Increasing pumping efficiency of an industrial pumping loop from 95 to 7 hp
- Achieving a 29% reduction in electricity consumption (at equal production), a 45% drop in water usage, and a 29% decrease in the emission of greenhouse gases.
Old design mentality

Optimize each part in isolation

*(which pessimizes the system)*
Invention is “... a sudden cessation of stupidity”
An example:

- Redesigning a standard (supposedly optimized) industrial pumping loop cut power from 95 to 7 hp (–92%), cost less to build, and worked better.
No new technologies, just two design changes

1. Big pipes, small pumps (not the opposite)
2. Lay out the pipes first, then the equipment (not the reverse)

Optimize the WHOLE system, and for multiple benefits
Once you’ve minimized flow, next minimize piping friction

Boolean pipe layout vs. hydraulic pipe layout
Old design mentality

- marginal cost of efficiency improvement
- cost-effectiveness limit
- diminishing returns
- cumulative resource savings

STOP!
New design mentality

![Graph showing the relationship between cumulative resource savings and diminishing returns. The graph illustrates how to radially increase resource productivity.](Image)

Marginal cost of efficiency improvement vs. cumulative resource savings. The graph shows how to "tunnel through the cost barrier" to achieve even bigger and cheaper energy savings.
Grow bananas with no furnace at –40ºF
Compounding losses...or savings—so start at the downstream end

- Power plant losses 70%
- Transmission and distribution losses 9%
- Motor losses 10%
- Drivetrain losses 2%
- Pump losses 25%
- Throttle losses 33%
- Pipe losses 20%

Fuel input = 100

P2: Biomimicry

Closed loops, no waste, no toxicity

Nature as model, measure, and mentor
Nature as mentor

spider silk
Three levels of biomimicry

Process:
How is it made?
Of 8,000 tested, only 38 cloth treatment chemicals were non-toxic. Upholstery edge trimmings: toxic waste.
Natural cloth treated with the safe chemicals looked and felt better, lasted longer, and cost less
Swiss environmental inspectors found: effluent water was cleaner than the Swiss drinking water going in
Three levels of biomimicry

Design: How does it work?
Design: How does it work?

How does nature stay cool?

Termite mounds

- Low energy-intensive materials
- Passive air conditioning

Africa, Australia, and the Amazon
Three levels of biomimicry

System:
How does it fit?
Kalundborg, Denmark

- Statoil Refinery
- Gyproc
- Asnaes Power Plant
- City of Kalundborg
- Novo Nordisk
Kalundborg, Denmark

Statoil Refinery

Fuel Gas

Asnaes Power Plant

Waste heat

Steam

Novo Nordisk

City of Kalundborg

Gyproc

Steam

Rocky Mountain Institute (RMI) Research & Consulting • www.rmi.org
Kalundborg, Denmark

- Lake Tisso
- Asnaes Power Plant
- Statoil Refinery
- Gyproc
- City of Kalundborg

- Fuel Gas
- Waste heat
- Waste heat (salt water)
- Fly ash

- Novo Nordisk
- Fish farms

Natural Capitalism: Biomimicry
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Kalundborg, Denmark

- Kemira Acid Plant
  - Sulphur
  - Scrubber sludge
  - Waste heat

- Statoil Refinery
  - Gypsum
  - Fuel gas

- Asnaes Power Plant
  - Waste heat
  - Fly ash

- Gyproc
  - Waste heat

- City of Kalundborg
  - Roads

- Lake Tisso

- Farms
  - Yeast for pigs

- Novo Nordisk
  - Fish waste

- Fish farms
Kalundborg, Denmark

Annual savings:

• $12–15 M USD
• 30,000 tons of coal
• 19,000 tons oil
• 600,000 cubic meters of water
P3: Shift to a solutions economy

From product to service

What are customers trying to solve?

“Less stuff… more service”
Hot showers and cold beer
End-use, least-cost analysis

- **From: Supply-side focus:**
  How to get *more* resources?

- **To: Demand-side focus:**
  What’s the least expensive, least polluting way to deliver those services?
Xerox

Capitalized on existing leasing programs to build a “take-back” infrastructure & a “document services” business
“Everything that Xerox delivers to its customers is designed to be returned -- whether it’s a machine, a cartridge, a spare, or packaging. All of these items, once returned, are processed for reuse or recycling. The only thing we want to leave with our customers is - THE DOCUMENT”.

* Xerox Corporation, “the Environmental Call: What on Earth Are We Doing for Customers?” Xerox Environment, Health and Safety, 1997
P4: Reinvest in
natural and human capital

Protect, enhance, restore and let nature renew
New York City needed to upgrade its drinking water system.
New water filtration plant at $4-$6 billion + $300-$500 million/year for maintenance
Instead …

NYC invested in the integrity of the watershed
- Purchased land as buffers
- Helped farmers reduce discharge
- Upgraded local sewage treatment plants

...Cost = $1.7 billion
What’s stopping us?

- Short term financial pressures
- Accounting practices
- Purchasing practices
- Design and engineering practices
- Measurement systems
- Reward and recognition programs

We can create a new future, a new vision
Private-sector leadership

- Over half the world’s 100 largest economic entities today are not nation-states but corporations
- The business community may be the only institution that has the resources, skills, and motivation to solve these tough problems.
Archetype for the emerging world…

Natural-capitalist businesses take their values from their customers, their designs from nature, and their discipline from the marketplace.
“Whatever you can do, or dream that you can do, begin it. Boldness has genius, power and magic in it. Begin it now.”