Saving Forests from the Demand Side

Invited remarks by Amory B Lovins

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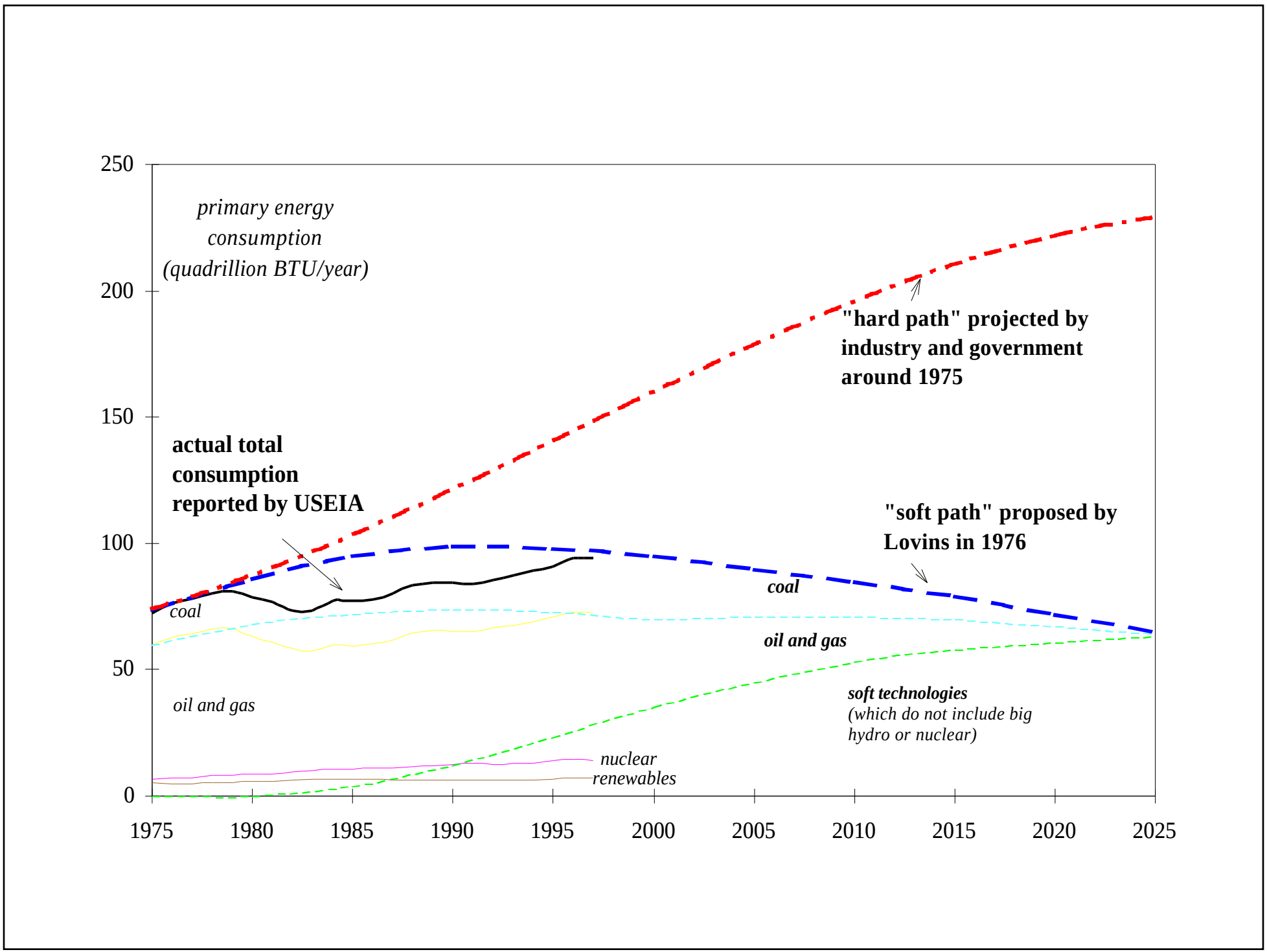
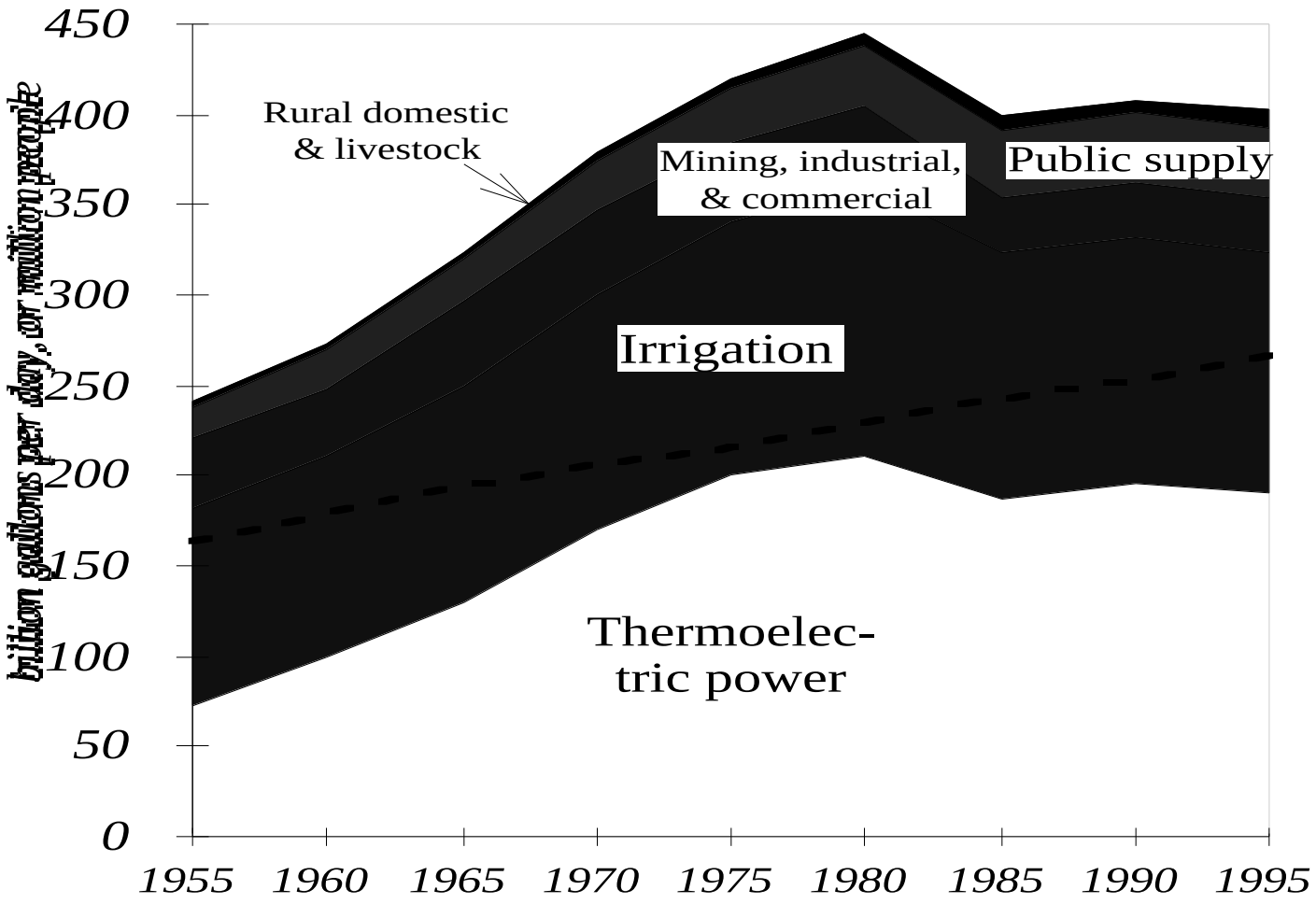
Including summaries of findings of a working group of the Systems Group on Forests (RMI, 1995–98, to be published ~1999) and of research by Chris Lotspeich *et al.* documented in *Natural Capitalism* (P G Hawken, A B Lovins, & L H Lovins, 9/99)


250
200
150
100
50
0
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
primary energy
consumption
(quadrillion BTU/year)
"hard path" projected by
industry and government
around 1975
actual total
consumption
reported by USEIA
"soft path" proposed by
Lovins in 1976
coal
coal
oil and gas
oil and gas
soft technologies
(which do not include big
hydro or nuclear)
nuclear
renewables

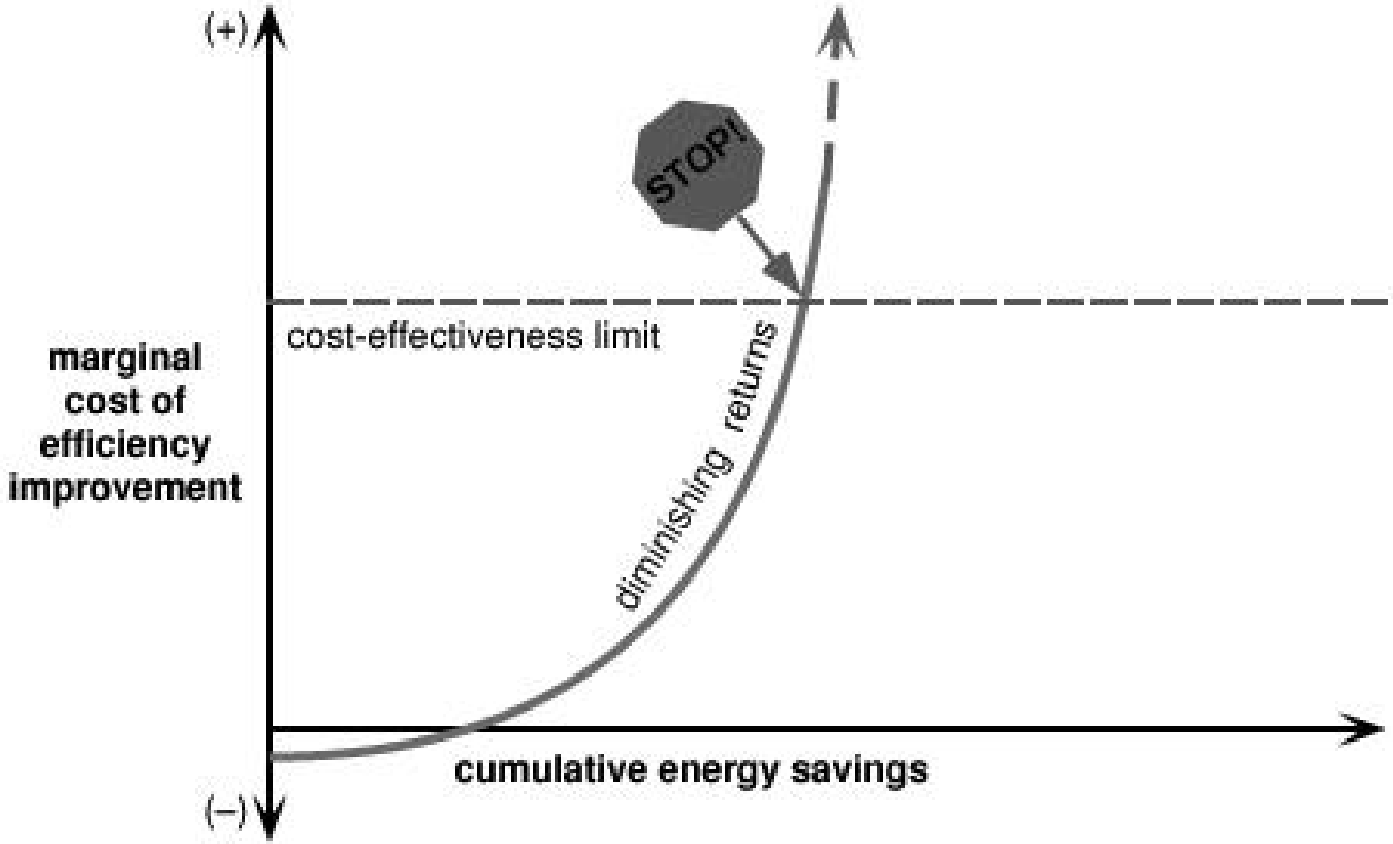
Water withdrawn for U.S. use: declining since 1980 despite rising population (dashed line)



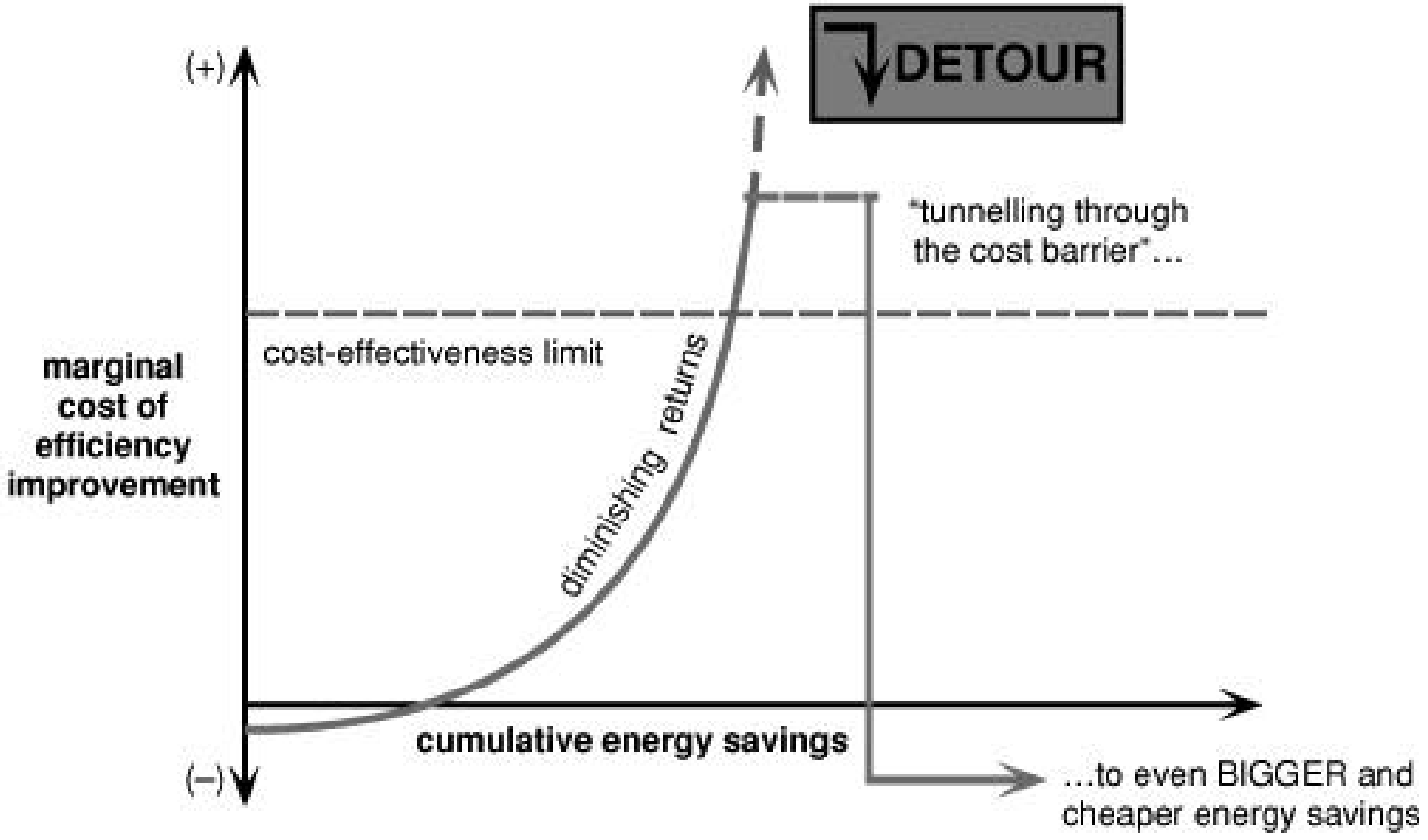
What goes up can come down

- US primary energy/GDP –36% so far: saved $150–200b/y, still wasting >$300b/y
- US 1979–86: GDP +19%, pri energy –6%
- US resumed a comparable (3.2%/y) rate of savings in 1996–99 despite record low & falling prices
- US is saving water twice as fast as energy: in CA, industrial output in ’80s +30%, water withdr –30%
- Even driving/car may stabilize/fall (many reasons)
- Oil endgame now beginning—likely to become uncompetitive even at low prices before unavailable even at high prices; a precedent for wood?

Will alternatives exhibit diminishing returns...



...or expanding returns?



By 2050, an affluent world could meet or beat a 3–4× C reduction goal

$$C_{energy} = \frac{\underset{\times 2}{population} \times \underset{\times\, 3\text{–}4}{affluence\ per\ capita} \times \underset{\times\sim 2\text{–}4}{carbon\ \text{intensity}}}{\underset{\times\, 1.5}{\text{conversion eff.}} \times \underset{\times\, 4\text{–}6}{\text{end-use eff.}} \times \underset{\times\, 1\text{–}2?}{\text{hedonic eff.}}}$$

or ~1.5–12× *lower* emissions despite assumed 6–8× growth in GWP. (A 1993 UN study* found 1.35× and 8× respectively, 1985–2050.) Great flexibility is thus available. *The future is not fate but choice.*

*Johansson, Kelly, Reddy, Williams, & Burnham, *Renewable Energy*, 1177 pp., Island Press, Washington DC.
This analysis, though mostly excellent on the supply side, assumed relatively weak end-use efficiency opportunities.

What causes the extractive demand upon natural forests?

In a "snapshot" at a given moment, and ignoring important differences between and within societies, it results from seven terms, all of which are not fate but choice, *each* of which can be increased or decreased, and some of which may interact with each other:

human **population**	× per-capita **demand for end-use services** now provided by physical artifacts made from forest products	× **portion** of that service demand that would be *actually* **provided by forest products** after substituting other means	× **throughput** of forest products needed to maintain the desired stock of physical artifacts	÷ **efficiency** of converting forests into forest products (*e.g.*, roundwood, market pulp, fuelwood)	÷ **efficiency** of converting forest products into intermediate goods (*e.g.*, dimensional lumber, paper, fuel)	÷ **efficiency** of converting intermediate goods into end-use services (shelter, information, cooked food,...)	÷ **efficiency** of converting end-use services into human happiness and satisfaction
influenced by: family planning gender roles social welfare land tenure social norms religious doctrines ...	prices progress metrics values what do we want? how much is enough? equity concerns religious and moral norms	"transparent" or "noticeable" substitutions substitutions at various levels: functionality, materials, purpose,... possibly +/– in other respects	min.-materials design net-shape design & mfg. scrap recovery longevity repair/reuse remanufact'g. recycling downcycling recovery as feedstock or fuel	where/when to log extractive practices field loss transport loss storage loss spoilage processing loss	logistical loss transport loss processing loss storage loss spoilage market loss (production/sales mismatches, returns,...)	*e.g.*: engineered wall (better, –74% wood, lower-quality wood); duplex copying, electronics, nega-information; efficient cookers & pots, effective solar cookers	*e.g.*, less junk mail, higher-quality services, more wanted and fewer unwanted services, meeting nonmaterial needs by nonmaterial means, sufficiency
long-term flexibility: ~2×	unknown, possibly severalfold	much, perhaps most, of current demand	at least severalfold	significant to manyfold	significant to manyfold	severalfold to manyfold	?

so the flexibility terms multiply to 1–3 orders of magnitude, mostly from technical fixes!

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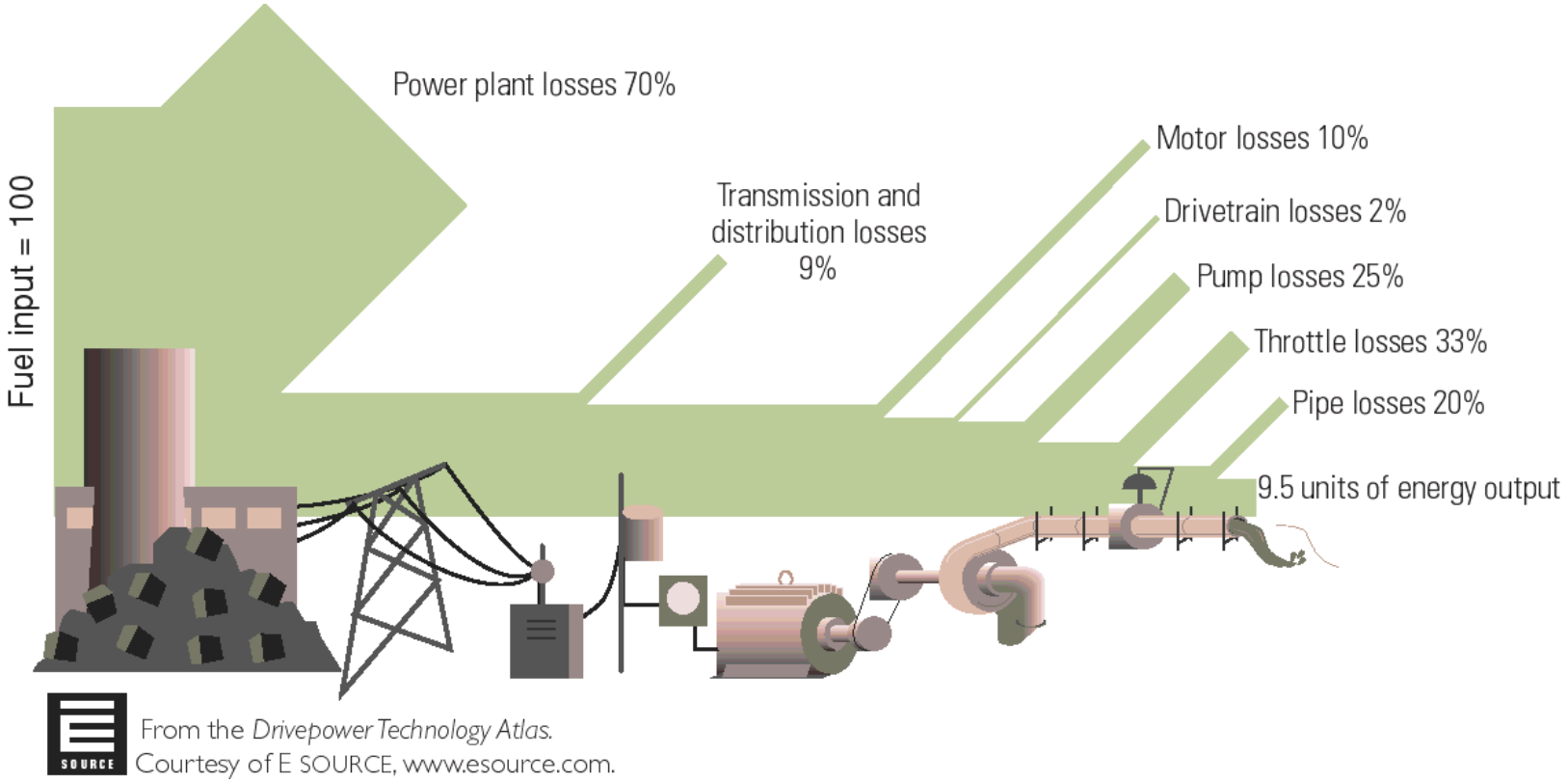
With a few qualifications...

- Formula is heuristic, not exhaustive
  - *E.g.*, omits such indirect methods as saving forests by using electricity more efficiently instead of flooding forests for hydroelectric dams
  - Ignores complex price & physical interactions
  - Omits other pressures (clearance, fuels, roads, land tenure, social complexities,...)
- Some ambiguities about where a term should go (just count it once and only once)
- Still useful, because it emphasizes many multiplicative options, starting downstream

Some nifty forest-products numbers

- Fiber usually a small fraction of total societal value
- Noncommercial uses (fuelwood) and complex sociopolitical and land-use issues often important
- U.S. fiber harvest mass is >2× metals purchases
- Produces ~half paper/paperboard (fast-growing markets), ~half lumber at ~2–5× higher prices/m^3
- Paper is 2% of world trade, $2^1/_2$% of ind. prodn.
  - U.S. shipments $132b/y, ~pri. metals/minerals, ~0.9× petrochemicals; ~90% of usage ephemeral, not archival
- 20^{th}-C. US fiber/cap –2.5%/y: GDP × 6, use ×<2
- 5 SGF case-studies found ~75–80% fiber savings
- Biggest leverage starts all the way *downstream*

Compounding losses...or savings



Electrons for fiber, pixels for paper

- Hard disks sell for a few ¢ per ream-equivalent
- Paperless office: strong cultural barrier, big gains
  - 29% of paper/p'bd; 5 sheets/cap-h, 100–200 lb/cap-y
- "Nega-information": paper saving as byproduct
  - Dow/Horgen: –30% in 6 weeks, productivity up more
  - Oticon –30–50%, byproduct of better decisionmaking
- Increasing innovations: BoA syndications (pot'l. 5M sheets/y), optical phonebooks / parts catalogs / *PDR*, web publications (a Sunday *NY Times* uses 75,000 trees; newsprint is 1/6 of US paper usage)

Dematerializing paper

- Reduced basis weight, higher opacity
- Improved strength/weight cut av. basis wt of US bleached paperboard (packaging) by ~1/5 in 10 y
- Johnson & Johnson: 30-mo effort saved (/y) 2750 t packaging, 1600 t paper, $2.8M, 134+ ha forest
- Eliminate overdesign in packaging (which is the largest US/UK use of paper products; 1/3 of W Eur muni waste, 2/5 of volume into US landfills)
  - 20–50% short-term reductions
  - Big Ger. retailer: 98% of secondary pkg'g unneeded
  - Canada's goal: 25% packaging reduction 1990–2000

Start downstream for greatest leverage

- Functional efficiency
  - Negainfo., no junk mail (1.5 trees/American-y)
  - WYSIWYG, preview, groupware, E-mail,....
  - –58% paper napkins by putting dispenser at the table
  - 2b people won't need phone poles (PV + wireless)
- Then end-use efficiency
  - Duplexing (partial use saved AT&T 15% of paper bill)
  - Fax-address stickies, not cover sheets
  - Returnable envelopes save 60–70% of envelope paper
  - Barcoding (esp. 2-D) replaces dossiers
  - E-mail (now >10 trillion words/y)
  - Technology does matter: forms bond stopped growing (US '94–2000 proj'd 0.1%/y *vs* uncoated freesheet 3.9)

Next, work back all the way upstream

- Then reduce new-materials dependence
  - Reuse the back for drafts/notes
  - Lower-basis-weight paper (EDF –23%, transp, postage)
  - “Detoner” printers/copiers emerging in US & Japan
  - Recycling (saves 1/2 energy = oil w/ 1/2 paper’s mass)
- Then substitute nonwood fiber
  - Some is higher-quality and m^3/ha-y than wood fiber
  - Nonwood paper 6%, growing 3× faster; ~80% in PRC
  - Avail. US ag. wastes (>280 Mt/y) ~ total US wood harv.
  - 10% straw to agropulp boosts OR farm profits 25–50%
- Then conversion efficiency (many small terms)
- Then field efficiency (~5–6× diffs. observed)

Multiplying savings like loaves and fishes

- Combinations can be powerful
  - Pará (Brazil): 28% better harvesting practice + raising sawmill eff. from 35% to 50% (*cf.* USSE 60%, best 70–80%) yields same net out, harvesting 45% less forest
  - If Brazil's sawmills matched best Japanese, field practice improved, & expected 2–3× gains in tree growth occurred, 60–83% fewer ha would deliver same output
  - If each of 10 elements in each of 8 terms saves only 2%, their combined effect is 0.98^{80}, or an 80% saving!
- Harvesting 5–20% of standing tropical trees can damage a further ~20–50% of surrounding trees & soil, esp. small trees vital to stand regen.; reverse it!

An example of multiplying paper savings

- × 0.90: E-mail, curbing unwanted printouts
- × 0.50: duplexing, scratchpaper reuse,...
- × 0.95: pulp-mill process/eq't upgrades
- × 0.2: softwood plantations for unmgd forest
- × 0.75: 60- to 45-lb basis wt, better opacity
- × 0.60: supplemental nonwood fiber + recyc.
- If no boomerangs, product is × *0.04*—a 96% saving (or w/o switch to plantations, × 0.19)
- Many of these assumptions are conservative

Structural applications

- Engineered wood products (*e.g.*, TrusJoist Mac-Millan's "Parallam") have ~1.8–2.4× product yield per m^3 fiber; use softer, smaller, lower-quality trees
- Even greater efficiency in structural performance
  - EWP I-joists w/44% less fiber—even more because no internal load-bearing walls are needed, higher space eff.
  - EWP framing system saved 70–74% of wood in stud-wall, wood/wall 0.35 to 0.09, –$433, 2× insul'n, stronger
- Fingerjointing yields 500–700 bd-ft/t wood "waste"
- Glue 4–5" logs' trapezoidal blocks into thick boards
- Novel I-beam joists, big hollow beams,...
- Bellcomb, Gridcore (–75–85%), C-Glulams (–67%)

Close materials loops

- Pallets use 11% of U.S. lumber, 2/5 of hardwood
  - 1.5b in U.S. (6/cap), + 0.4b/y; waste/y = 300k homes
  - Many firms repackage, reduce pallets/t shipped (to 0?)
  - Remfg: NYC $130M/y disposal cost; but Big City Forest recovered 50k pallets + furniture in first 20 mo, saving 1,500 t wood (>1M bd-ft) + $500k
  - RAN: 50% remfg = 2,500 inner-city jobs + 765M bd-ft/y = 152k acres timberland
  - German barcoding incentivizes durability, reuse, repair
- Paper: U.S. recyc. > landfill since ’93; nearing 50% of inputs (*vs*. 96% NL), but 20 Mt/y waste-wood, equivalent to 7% of harvest, still landfilled
- USNW: 1948–73 mill products/ha ×4, residues ÷4!

Process innovations continue

- Green Bay Packaging Co (WI banned paper from landfills in ’95) eliminated effluent from all-recycled paperboard, so could locate far from water
  - Goal: national network of regional minimills
  - Raised fiber recovery from 85–90% to 97–98%, equivalent to avoiding landfilling another 20kt/y
  - Became industry’s low-cost producer
- Recycle copiers (10×), Decopier (5×), polymeric ink (floats off in 55°C water, 10–13× paper life)
- E-paper (>1M trips) soon from Xerox PARC, MIT

With superefficient use, no forest cut?

- Sedjo: current world demand for industrial wood *fiber* (excl. fuelwood, slightly greater) could come from plantations on good forest land (8 m^3/ha-y: 2× av. US prod'y, 4-6× below fast-growing spp) equivalent to 5% of the world's currently forested land
- *Very*-high-yield plantations (40–70 m^3/ha-y) on 0.5–1% of current forest areas (23–40 Mha: *cf.* current plantations' 100–135, high-yield 14) could meet world wood-fiber demand @ current efficiency
- Improving downstream efficiency 3–5× in long run (prob. conservative) could cut this to ~0.1–0.3%, the size of Louisiana or Iowa—about the area of tropical forest being *lost each year* in early 1990s

Conclusions

- The innovations illustrated by these anecdotal examples, and the far larger potential still unexploited, suggest that efficiency and substitution in all forest-product value chains can profitably displace most/all cutting of natural forests, w/same services
- *Thorough* analysis is needed, including interactions (best protection against rebound: save everywhere)
- This cornucopia is the manual model!
- Some non-fiber values (C, watershed, tourism,...) are starting to be monetized; even in NZ's exotic softwoods, they're worth ~1.5× as much as fiber, which has ~6× av. US natural forests' yield/ha-y

But more juicy questions remain...

- Can saving wood fiber tunnel through cost barrier?
- What would full desubsidization really mean?
- What "barrier-busting" initiatives* can turn implementation obstacles into business opportunities?
- Ga.-Pacific CEO's remark about eco-accounting—should there be a major FASB/GAAP initiative?
- Business value of biodiversity—even to loggers
- Can Collins Pine's premium be generalized?
- What would make alts. clearly *more* profitable? (Example: Oil Era will end bec. it can't compete)
- *Change business model to a Solutions Economy?*

*See A B & L H Lovins, *Climate: Making Sense* and *Making Money*, RMI, 9/97, www.rmi.org/catalog/climate.htm, pp. 11ñ20.

To dig deeper...

- All RMI publications can be ordered, and many can be downloaded free, from www.rmi.org
- Publications related to Hypercars (a nega-OPEC), fuel cells, and H_2 are at www.hypercar.com
- Advanced energy efficiency information is sold at www.esource.com (a former RMI subsidiary)
- *Natural Capitalism* has >400 pp. & >800 refs., and will have its own part of the www.rmi.org website by ~9/99 when the book is published by Little Brown (NY) and Earthscan (London)