平成19年度（第16回）ブループラネット賞
受賞者記念講演会

2007 Blue Planet Prize
Commemorative Lectures

エイモリ・B・ロビンス 博士
講演スライド集
「ビジネス主導で採算もとれる気候変動・エネルギー問題の解決策」

Dr. Amory B. Lovins
Slides for Lecture
“Profitable, Business-Led Solutions to the Climate, Oil, and Proliferation Problems”

財団法人 旭硝子財団
THE ASAHI GLASS FOUNDATION

Blue Planet Prize Commemorative Lecture
United Nations University, Tokyo, 18 October 2007

Profitable, Business-Led Solutions to the Climate, Oil, and Proliferation Problems

エイモリ・B・ロビンス

Amory B. Lovins, Chairman and Chief Scientist
Rocky Mountain Institute, www.rmi.org

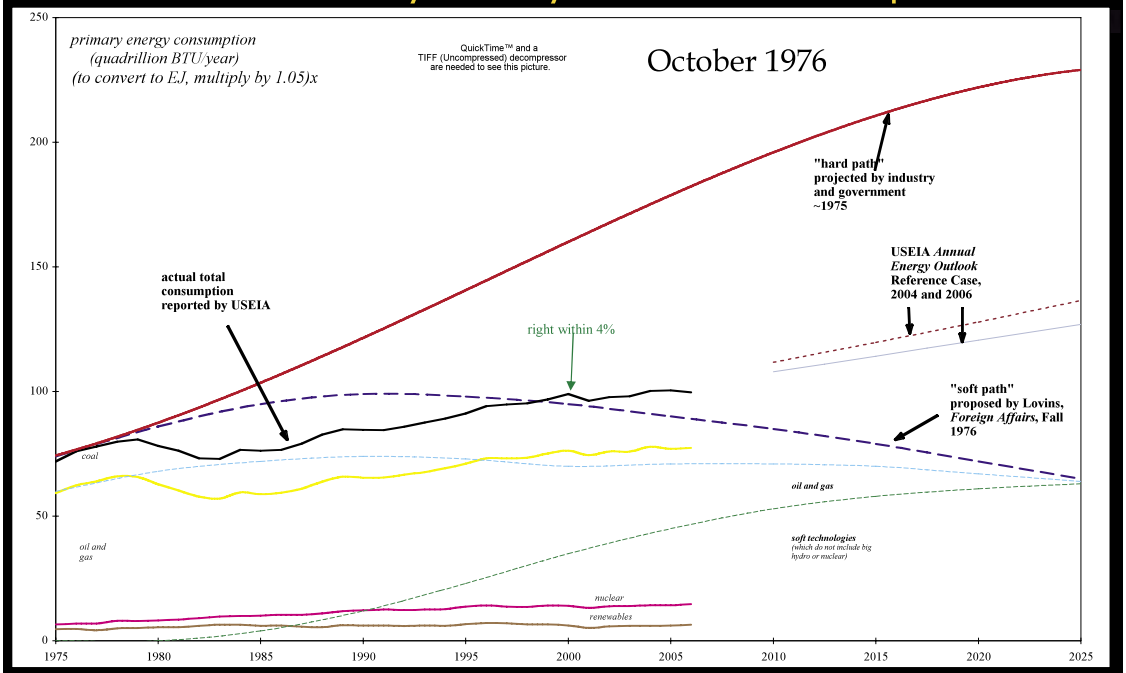
slide 1

What is the energy problem?

- Pre-1976 view, still held by some governments
  - Where can we get *more energy*, from any source, at any price?
  - That energy will increasingly be electricity, from giant stations
  - Only fossil fuels and nuclear will be important, not renewables
- Post-1976 view, held by many energy companies
  - What do we want energy *for*, and how much energy, of what quality, at what scale, can do each of those "end-use" tasks at least cost?
  - All ways to save or produce energy should be allowed to compete fairly, at honest prices, no matter which kind they are, what technology they use, how big they are, where they are, or who owns them
- The question you ask determines the answer you get —but some questions are more useful than others

slide 2

U.S. energy/GDP already cut 48%, to very nearly the 1976 "soft path"



but that just scratches the surface. esp. for el. & oil savings

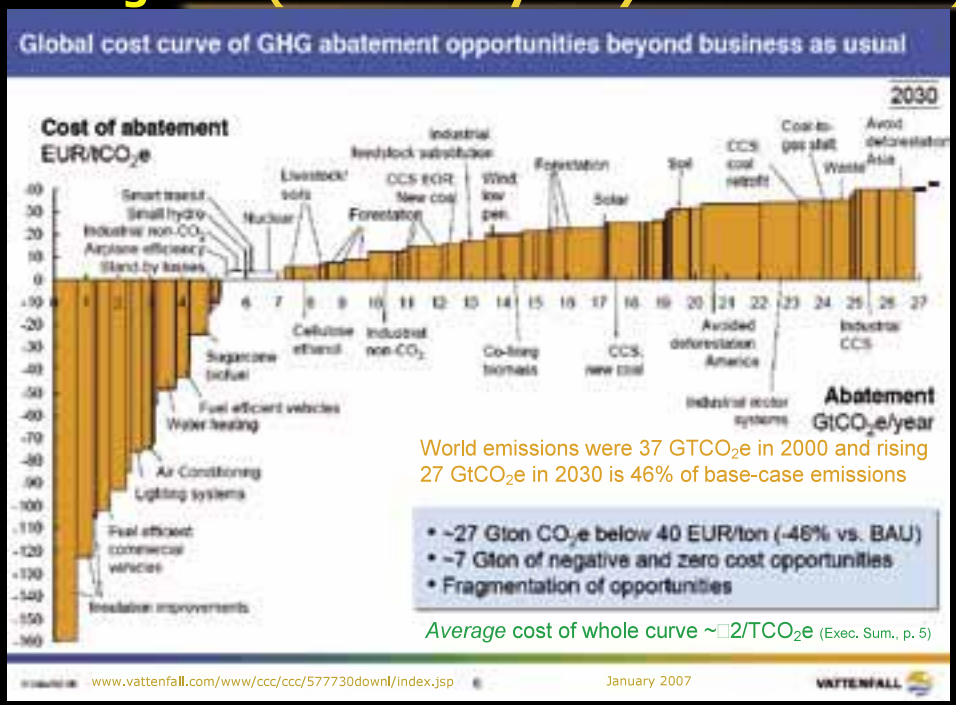
slide 3

U.S./Japan energy: different prices; other similarities are more important than differences

Attribute		
energy efficiency	Poor but +3%/y	better *but uneven*
oil consciousness	rising fast	high
oil resources	big, old, dwindling	none
renewable energy resources	huge, diverse, *badly underused* but rising	big, diverse, *largely unknown*
policy coherence	nationally poor, states often good	nationally strong, but mixed & opaque
tech. innovation	individualistic	corporate
main strength	entrepreneurial	cohesive
main weakness	dysfunctional, grid-locked national policy—but many workarounds	*belief* (not fact) that Japan is poor in energy and can't get much more efficient

slide 4

2007 McKinsey Global Institute (MGI) potential for abating global greenhouse gases (technically *very* conservative)



slide 5

Two "different but likely" Japanese societies in 2050

Matsuoka Yuzuru-sensei, Kyoto University, "Modeling Activity to Support Japan 'LCS Toward 2050' Project," 14 June 2006, Tokyo

Scenario A	Scenario B
Bustling, Technology-driven	Slow, Natural-oriented
Urban concentrated/ Individualistic	Decentralized, Community-oriented, Self-sufficient
Centralized production /recycle	Produce locally, consume locally,
Convenient and Beneficial	Social and Cultural Values

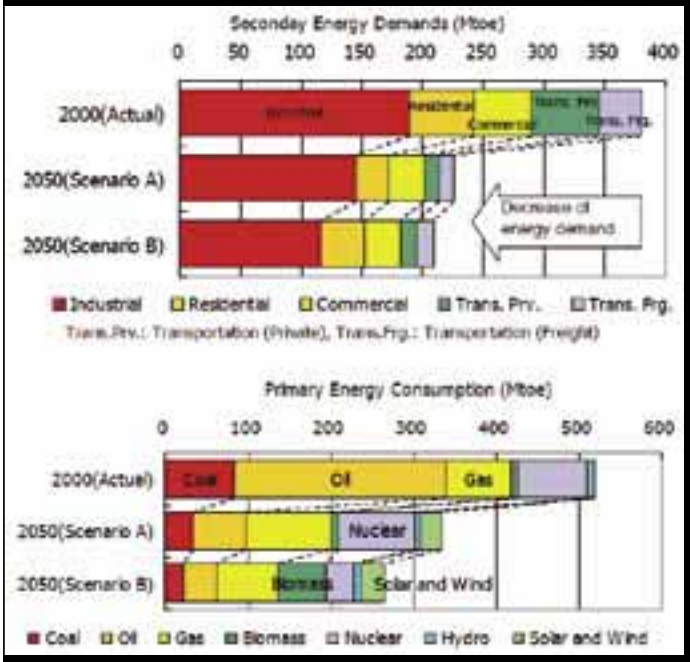
- National Institute for Environmental Studies 2005–
- ~60 diverse experts
- Consistent with existing long-term government plan (such as nuclear power)
- GDP growth per capita is 2%/y (A) or 1%/y (B)
- Both scenarios assume a vibrant society with much technological progress (though more in A)
- Some innovative but no speculative technologies

"Japan has the technological potential to reduce its CO_2 emissions by 70% compared to the 1990 level, while satisfying the expected demand for energy services in 2050."

slide 6

NIES 2050 Japan energy scenarios

NIES, "Japan Scenarios Towards Low-Carbon Society (LCS): Feasibility Study for 70% CO_2 emissions reduction by 2050 below 1990 level," February 2007



- Secondary energy demand *decreases* by 40–45%
- Thus secondary energy/GDP falls by 78% (A) or 66% (B)
- Based on careful analysis of how people spend their time and how they travel, urban design, industrial structure,….
- Service demand improvements cut CO_2 11–21%, fuel-switching in end-use sectors 19–48% and in power sector 15–34%; end-use efficiency cuts emissions *only 24–41%*
- Low-carbon energy supply
- 2050 extra cost ~¥0.7–1.8 trillion/y, ~0.1% of 2050 GDP
- Can we save more cheaper?

slide 7

Q. How is climate protection like the Hubble Space Telescope?

A. Both got messed up by a sign error—a confusion between "+" and "–"

slide 8

Saving energy is cheaper than buying it, so firms are starting to buy energy efficiency whether or not they worry about climate

- IBM and STMicroelectronics
  - CO_2 emissions –6%/y, fast paybacks
- DuPont's 2000–2010 worldwide goals
  - Energy use/$ –6%/y, add renewables, cut absolute greenhouse gas emissions by 65% below 1990 level
  - By 2006: actually cut GHG 80% below 1990, $3b profit
- Dow: cut E/kg 42% 1990–2005, $3.3b profit
- BP's 2010 CO_2 goal met 8 y early, $2b profit
- GE pledged 2005 to boost its eff. 30% by 2012
- Interface: 1996–2006 GHG –60% (–9.2%/y), aims to eliminate *all* waste by 2020 ($0.34b profit by '06)
- TI new chip fab: –20% en., –35% water, –30% capex

Politicians debate "costs," smart firms pocket profits!

slide 9

The climate problem is caused by one percentage point

(after Hoffert *et al.*, *Nature* **395**:881–884 (1998))

The "Kaya identity" (Kaya Youichi-sensei) shows that:

Emitted CO_2/y = N × GDP/N × $\dot{E}_{primary}$/GDP × C/$E_{primary}$

1990–2100 %/y: +0.69 +1.6 −1.0 −0.26 = +1.0

That +1%/y causes C growth from ~6 to ~20 Gt/y

Supply-siders debate the –0.26%/y (no-C energy) term

But let's examine the 4× bigger energy-intensity term… because *–1%/y → –2%/y flattens CO_2 emissions* (or saves ~30 TW of no-C supply required for 550 ppm), and reducing energy intensity slightly faster, say 3%/y, would stabilize Earth's climate…still at a profit

So how plausible is a 2–3%/y, or even faster, reduction in energy used per unit of GDP?

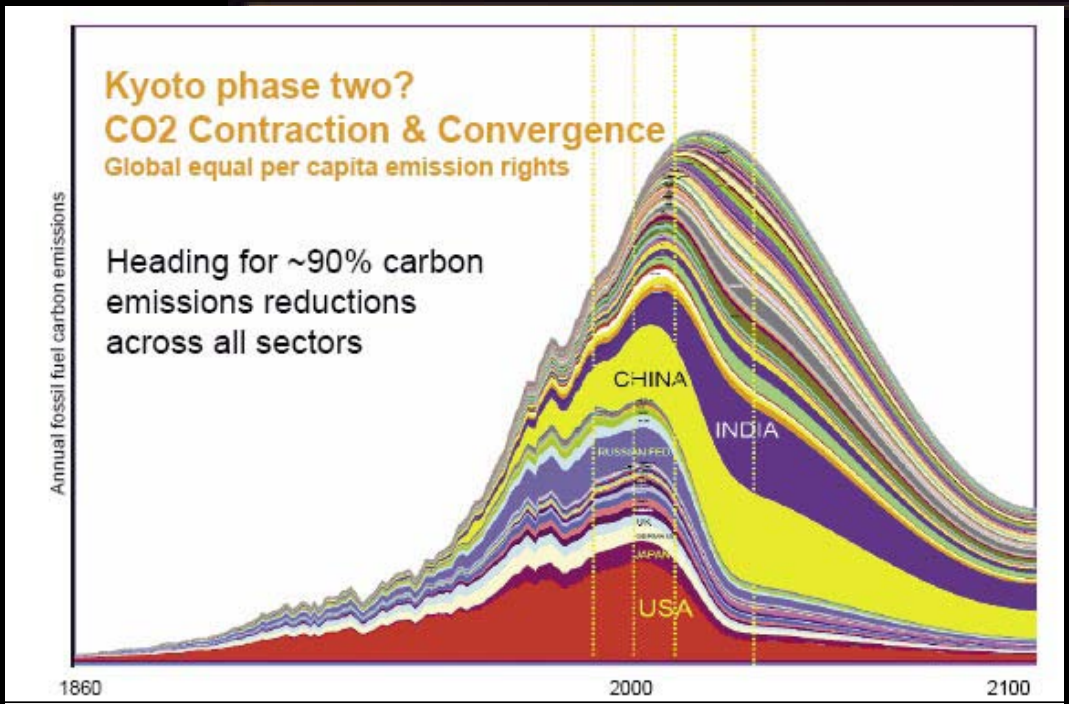
slide 10

Profitable climate protection

- The U.S. has spontaneously saved >2%/y since '97, 3.4%/y in '81–86, 3.2%/y in '01 & '05, 4.0% in '06
- California was ~1 percentage point faster; its new homes use 75% less energy; still saving much more
- China did even better—it saved >5%/y for >20 y, 7.9%/y 1997–2001 (then reversed '02–06); energy efficiency is *the* top strategic development priority; 11th 5-Year Plan sets 20% (4.5%/y) savings 2005–10
- Attentive companies profitably save ~6–9%/y
- So why should 3%/y be difficult—or costly?
- Japan's E/GDP fell 0.7%/y 1977–2004; government's New National Energy Strategy (Jan. 2006) calls for 1.5%/y to 2030; NIES would be 1.7–2.4%/y to 2050

slide 11

So could the vision of contraction & convergence be feasible *and profitable*?



slide 12

An all-too-common belief

"Japan's energy efficiency level is unlikely to improve much, since it is already the best in the world."

—*Yomiuri Shimbun*, 7 January 2006

But doesn't *kaizen* apply also to energy?

Isn't Japan still the world's best at *kaizen?*

Japan can lead this global *hiyaku* (飛躍)!

Japanese frogs jump too!

The old pond
frog jumps in
plop

—Bashô

古池や
蛙飛び込む
水の音

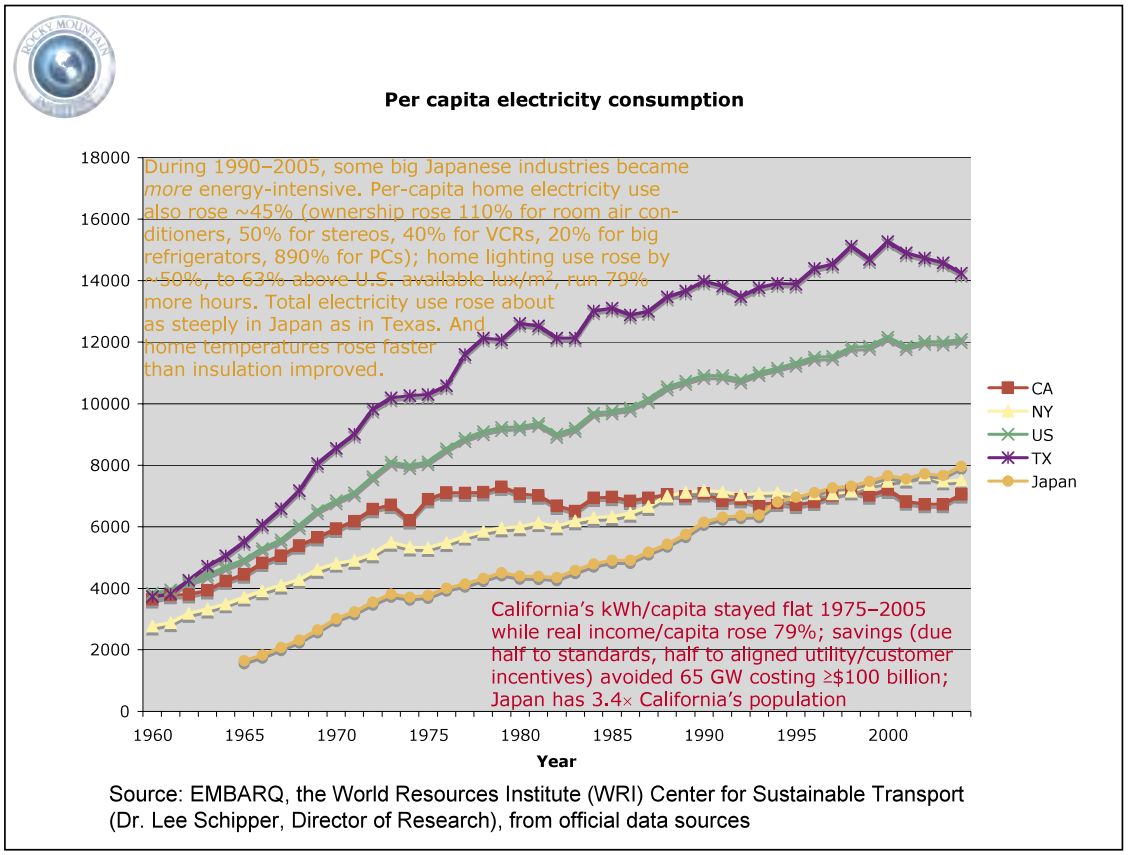
Let's see how, focusing on oil (42% of global CO_2 emissions) and electricity (40%)

slide 13

Some of Japan's impressive CO_2 achievements so far…

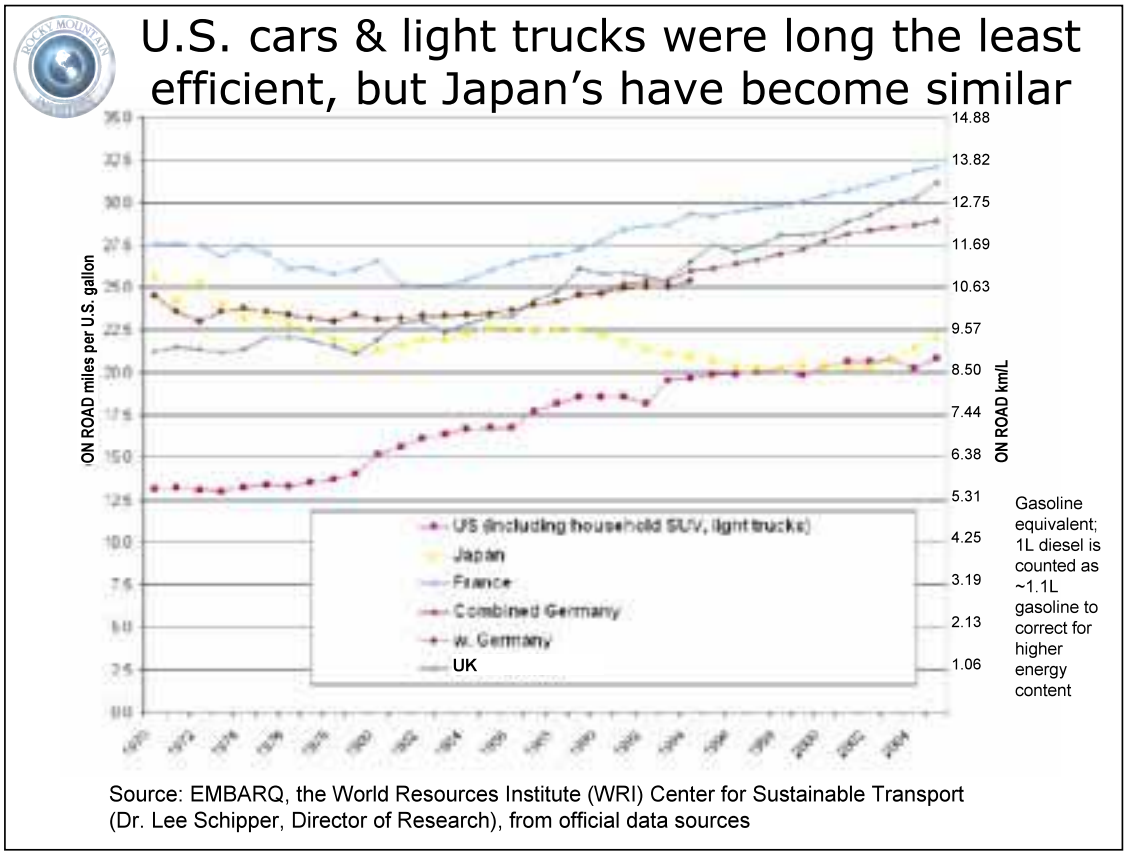
- Toyota cut CO_2 per car produced by 15%, 2002–05
  - Single line / multiple models cuts energy as much as 40%
  - New 2003– welding system cuts CO_2 50%, cuts time & cost
- Nissan aims to cut CO_2 by 2007 to 2000 – 10%
- Honda during 1Q2001–07 cut CO_2 mfg. emissions in Japan by 9.5%/car and 29.3%/motorcycle; also raised average car fuel economy 31% 1995–2005
- Ricoh expects to cut 2010 CO_2 to 1990 – 12%
- Kirin's 2010 goal (1990 – 25%) was reached in '06
- And many more
- But outside leading firms, the picture is less rosy…

slide 14



Source: EMBARQ, the World Resources Institute (WRI) Center for Sustainable Transport (Dr. Lee Schipper, Director of Research), from official data sources

slide 15



Source: EMBARQ, the World Resources Institute (WRI) Center for Sustainable Transport (Dr. Lee Schipper, Director of Research), from official data sources

slide 16

If we got serious, what more could fully-adopted end-use efficiency do?

- ◊ Save more than half of US oil at an average cost of $12/bbl (2000 $)—1/6 its July 2007 world price
- ◊ Save at least half of US natural gas at an average cost <$0.9/GJ—1/8 its US price
- ◊ Save at least three-fourths of US electricity at an average cost ≤1¢/kWh—1/8 its US price

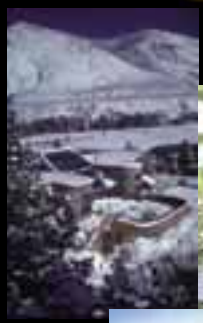
Total *marginal* cost of achieving such savings overnight in 2006 would be only of order $94b/y (2006 $), or $1.2 trillion (20-y present value)—1/6th their value

Such savings would also cut prices and volatility, keep supplies cheaper for longer, slash CO_2 emissions, improve security, and buy precious time

But these techniques' *percentage* savings potential is not so very different in Japan, which has better industry, worse buildings, and broadly similar vehicles

slide 17

–44 to + 46°C with no heating/cooling equipment, *less* construction cost



2200 m, frost any day, 39 days' continuous midwinter cloud…yet 28 banana crops with no furnace

Key: integrative design—multiple benefits from single expenditures

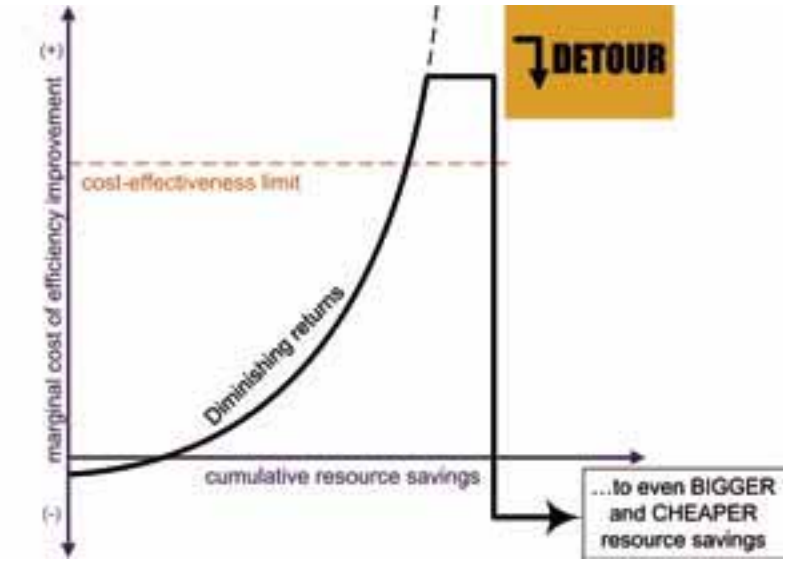
- ◊ Lovins house / RMI HQ, Snowmass, Colorado, '84
  - ○ Saves 99% of space & water heating energy, 90% of home el. (372 m² use ~120 W_{av} costing ~$5/month @ $0.07/kWh)
  - ○ 10-month payback in 1983
- ◊ PG&E ACT², Davis CA, '94
  - ○ Mature-market cost –$1,800
  - ○ Present-valued maint. –$1,600
  - ○ 82% design saving from 1992 California norm, ~90% from US
- ◊ Prof. Soontorn Boonyatikarn house, Bangkok, Thailand, '96
  - ○ 84% less a/c capacity, ~90% less a/c energy, better comfort
  - ○ No extra construction cost

slide 18

Old design mentality: always diminishing returns...

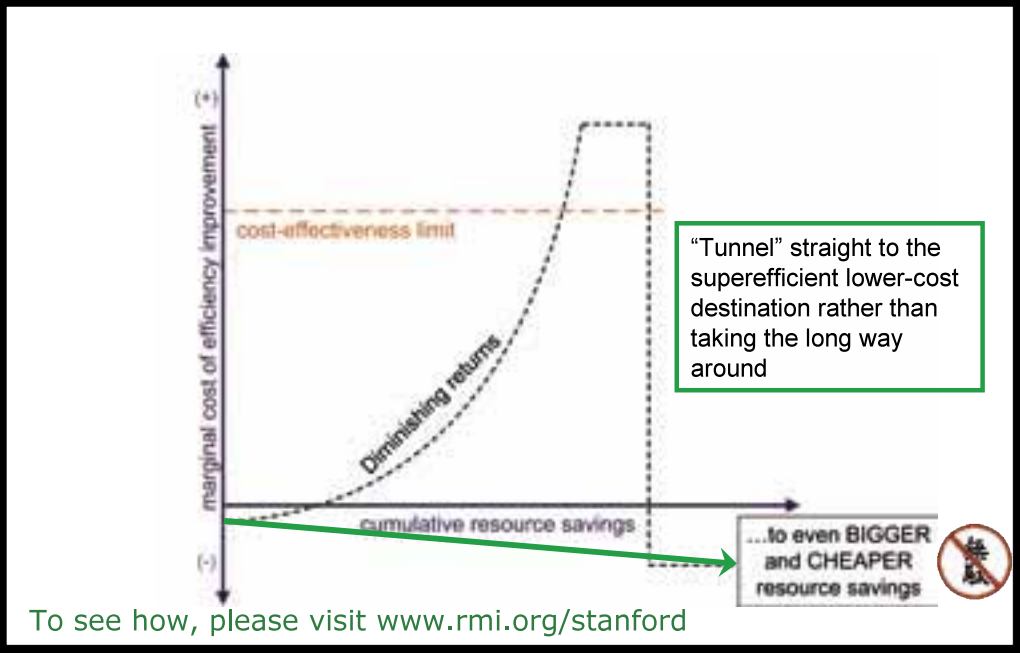
slide 19

New design mentality: expanding returns, "tunneling through the cost barrier"



slide 20

New design mentality: expanding returns, "tunneling through the cost barrier"



slide 21

Cost can be negative even for retrofits of big buildings

- 19,000-m^2, 20-year-old curtainwall office near Chicago (hot and humid summer, cold winter)
- Dark window units' edge-seals were failing
- Replace not with similar but with superwindows
  - Let in nearly 6× more light, 0.9× as much unwanted heat, reduce heat loss and noise by 3–4×, cost \$8.4/m^2_{glass} more
- Add deep daylighting, plus very efficient lights (3 W/m^2) and office equipment (2 W/m^2)
- Replace big old cooling system with a new one 4× smaller, 3.8× more efficient, \$0.2 million cheaper
- That capital saving pays for all the extra costs
- 75% energy saving—*cheaper* than usual renovation

slide 22

Pumps are the biggest use of motors, which use 3/5 of global electricity

◊ Redesign of a supposedly optimized standard industrial pumping loop cut its power from 70.8 to 5.3 kW (–92%*), cost less to build, worked better

◊ Simply change design mentality: use fat short straight pipes rather than thin long crooked pipes

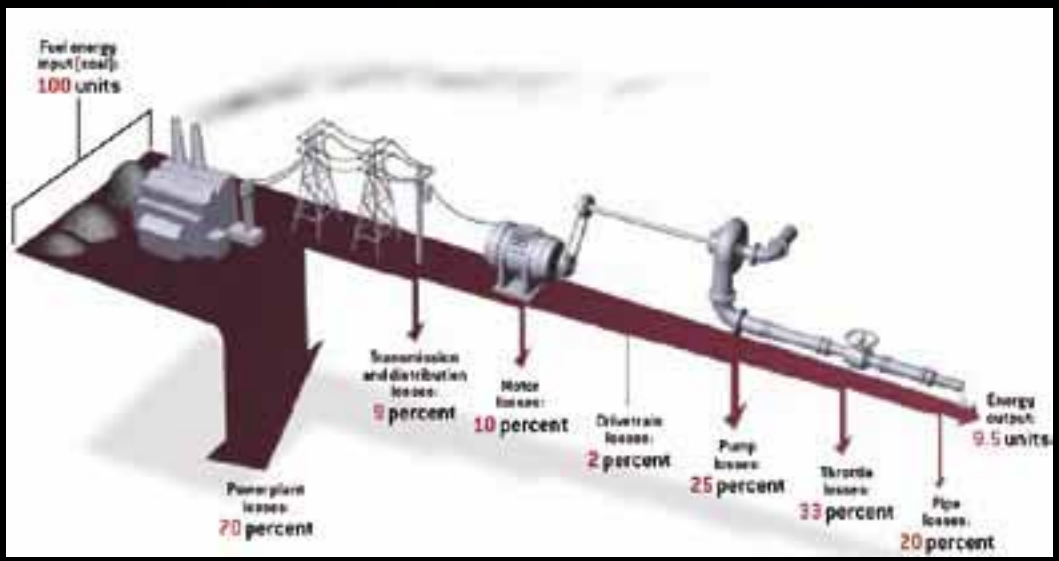
◊ Better optimization would save ~98%, cost less

◊ Such integrative design can save 75–80% of *all* el.

*The designer's spreadsheet contains an error whose correction indicates an 84% saving, but he told me the measured saving confirmed the original 92% estimate. He has retired; we are trying to track down this discrepancy.

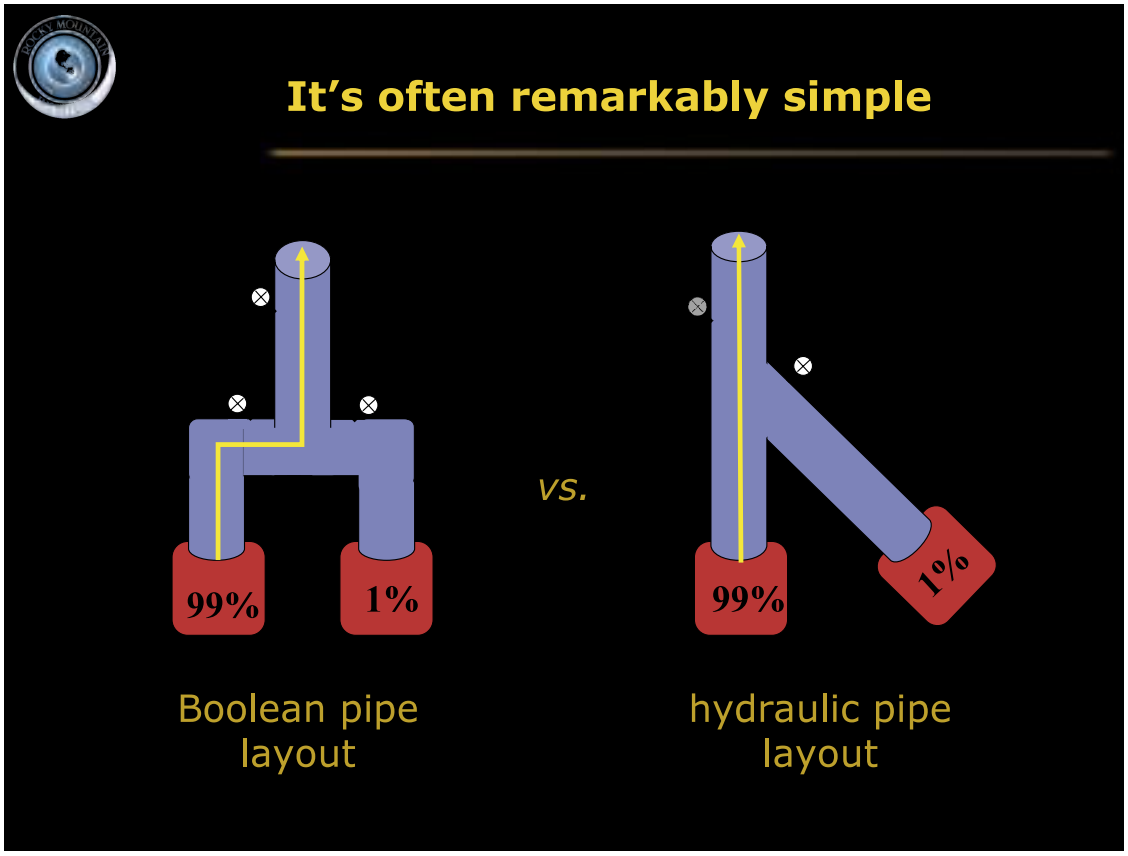
slide 23

Compounding losses...or savings...so start saving at the *downstream* end to multiply the fuel and equipment savings upstream

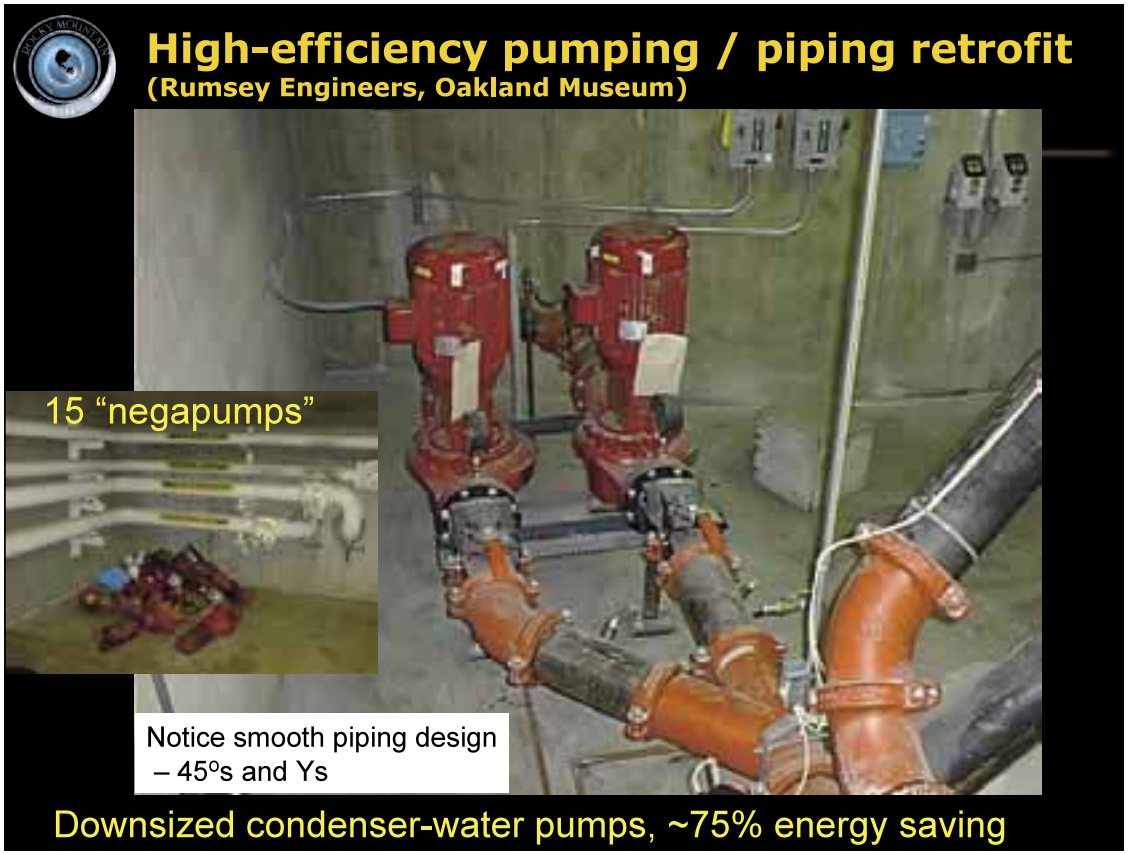


So each unit of avoided flow or friction at the pipe saves **ten** units of fuel at the thermal power station

slide 24



slide 25



slide 26

Examples from RMI's industrial practice (>$30b of facilities)

- Save half of motor-system electricity; retrofit payback typically <1 y
- Similar ROIs with 30–50+% retrofit savings of chip-fab HVAC power
- Retrofit very efficient oil refinery, save 42%, ~3-y payback
- Retrofit North Sea oil platform, save 50% el., get the rest from waste
- Retrofit USNavy *Aegis* cruiser's hotel loads, save ~50%, few-y paybacks
- Retrofit big LNG plant, ≥40% energy savings; ~60%? new, cost less
- Retrofit giant platinum mine, 43% energy savings, 2–3-y paybacks
- Redesign $5b gas-to-liquids plant, –$1b capex, save >50% energy
- Redesign new data center, save 89%, cut capex & time, improve uptime
- Redesign next new chip fab, save ~67%, cut capex ~50%, no chillers
- Redesign new supermarket, save 70–90%, better sales, ?lower capex
- Redesign new chemical plant, save ~3/4 of el., cut time and cost ~10%
- Redesign cellulosic ethanol plant, save 50% steam, 60% el., ~2/3 capex
- Redesign new 58m yacht, save 96% potable H_2O & 50% el., lower capex
- "Tunneling through the cost barrier" now observed in 29 sectors
- None of this would be possible if original designs had been good
- Needs engineering pedadogy/practice reforms; see www.10xE.org

QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.

slide 27

Business-based oil *solution*

Independent, detailed, peer-reviewed, transparent

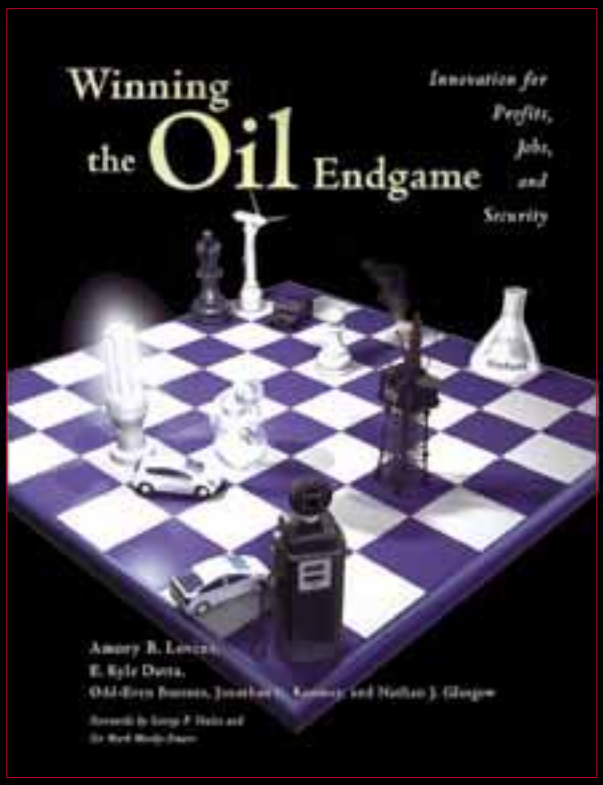
Cosponsored by DoD

For business & mil. leaders

Book and technical backup are free at:

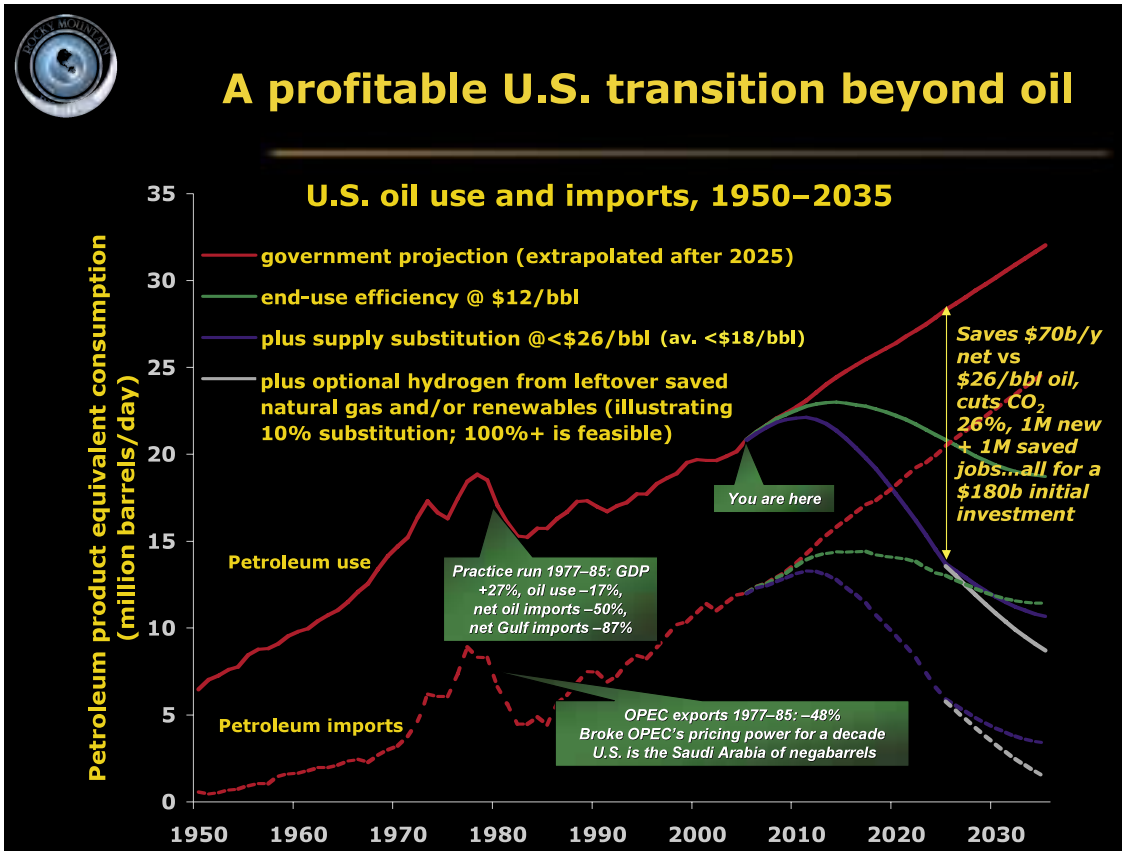
www.oilendgame.com

Over the next few decades, the U.S. can eliminate its use of oil and revitalize its economy, led by business for profit

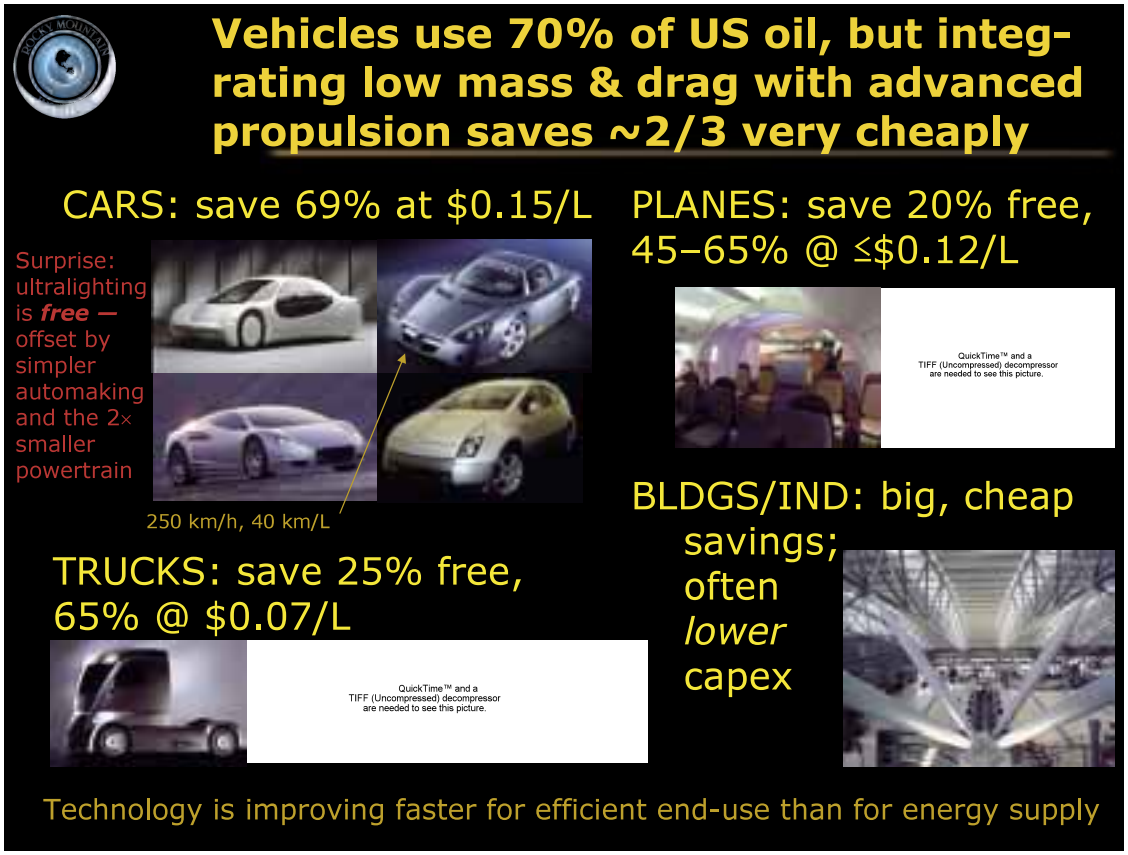


This work was cosponsored by OSD and ONR. The views expressed are those of the authors alone, not of the sponsors.

slide 28

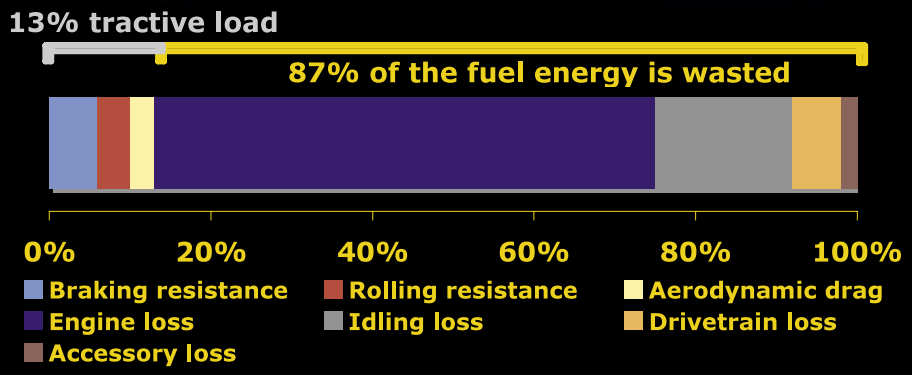


slide 29



slide 30

Each day, a typical car uses ~100× its weight in ancient plants. Where does that fuel energy go?



- 6% accelerates the car, 0.3% moves the driver
- Three-fourths of the fuel use is weight-related
- Each unit of energy saved at the wheels saves ~7–8 units of gasoline in the tank (or ~3–4 with a hybrid)
- **So first make the car radically lighter-weight!**

slide 31

Three technology paths: aluminum, light steels, carbon composites (the strongest & lightest)

- Immaterial damage when T-boned by *Golf*
- 7 kg of carbon crush cones (0.4% of car's weight) can absorb all crash energy @ 105 km/h

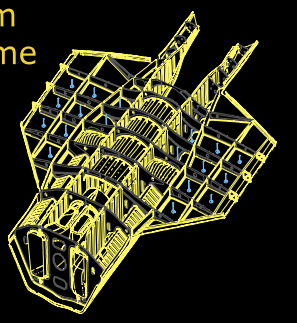
- **Carbon-composite crush structures can absorb 6–12× as much energy per kg as steel…and more smoothly**
- **This can make cars lighter *but* bigger *and* safer… *and* simpler and potentially cheaper to manufacture**

slide 32

Migrating innovation from military/ aerospace to high-volume vehicles

- 1994–96: DARPA/IATA* Skunk Works® team designed an advanced tactical fighter airframe
  - made 95% of carbon-fiber composites
  - 1/3 lighter than its 72%-metal predecessor
  - *but 2/3 cheaper…*
  - because designed to be made from carbon, not from metal

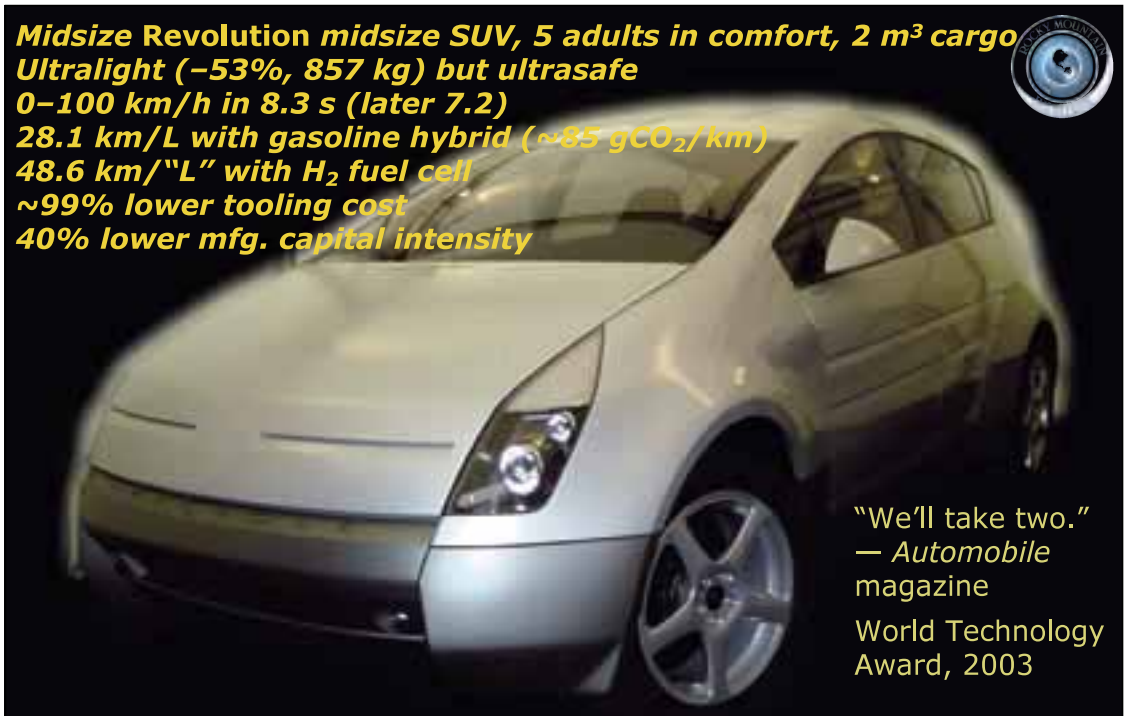
*Integrated Technology for Affordability (IATA)



- Finding no military customer for something so radical, the team leader left. I hired him to lead the 2000 design of a halved-weight SUV with two Tier Ones, *Intl. J. Veh. Design* **35**(1/2):50–85 (2004)
- Manufacturing method for competitive carbon-fiber structures is being rapidly commercialized

slide 33

Midsize* Revolution *midsize SUV, 5 adults in comfort, 2 m³ cargo
Ultralight (–53%, 857 kg) but ultrasafe
0–100 km/h in 8.3 s (later 7.2)
28.1 km/L with gasoline hybrid (~85 gCO_2/km)
48.6 km/"L" with H_2 fuel cell
~99% lower tooling cost
40% lower mfg. capital intensity



"We'll take two."
— *Automobile* magazine

World Technology Award, 2003

Show car and a complete virtual design (2000), uncompromised, production-costed, manufacturable; hybrid yields 1-y payback *vs* Japan gasoline

slide 34

Can U.S. automakers use efficiency as a competitive strategy (as Japanese ones just did)?

- Boeing's crisis in 1997 was like Detroit's today
  - Wrenching changes instituted at BCA, including TPS (*e.g.*, moving assembly); manufacturing and costs brought back under control
  - But what about growth? What was in the pipeline after *777*?
- In 2003, Airbus for the first time outproduced Boeing
  - "This is really a pivotal moment…could be the beginning of the end for Boeing's storied airplane business" — analyst Richard L. Aboulafia, 2003
- Boeing's bold, efficiency-led 2004 response: *787 Dreamliner*
  - ≥20% more efficient than comparable modern aircraft, *same price*
  - 80% advanced composite by volume, 50% by mass →
    - Bigger windows, higher-pressure cabin
  - 3-day final assembly (*737* takes 11 days)
  - 776 orders (683 firm + 93 pending), 378 additional options
  - Sold out into 2014—fastest order takeoff of any airliner in history
  - Now rolling out *787*'s radical advances to *all* models (Yellowstone)

- Airbus: Ultra-jumbo *A380*, 2 years late, ~€5b over budget
  - Response? Efficient, composite *A350*—probably too late
- Might U.S. automakers do this to Toyota, Nissan, and Honda?

slide 35

Implementation is underway via "institutional acupuncture"

- RMI's 3-year, $4-million effort is leading & consolidating shifts
- Need to shift strategy & investment in six sectors
  - Aviation: Boeing did it (*787 Dreamliner*)…and beat Airbus
  - Heavy trucks: Wal-Mart led it (with other buyers being added)
  - Military: emerging as the federal leader in getting U.S. off oil
  - Fuels: strong investor interest and industrial activity
  - Finance: rapidly growing interest/realignment will drive others
- Cars and light trucks: slowest, hardest, but now changing
  - Alan Mulally's move from Boeing to Ford with transformational intent
  - UAW and dealers not blocking but eager for fundamental innovation
  - Schumpeterian "creative destruction" is causing top executives to be far more open to previously unthinkable change
  - Emerging prospects of leapfrogs by China, India, ?new market entrants
  - Competition, at a fundamental level and at a pace last seen in the 1920s, will change automakers' managers or their minds, whichever comes first
  - RMI's two transformational projects and "feebate" promotion will help too

slide 36

The emerging automotive [r]evolution: beyond *WTOE*

- An excellent hybrid, properly driven, doubles efficiency
  - Considerably more if diesels or digital engines can meet air regs
- Ultralighting (+ better aero and tires) redoubles eff'y.
- Cellulosic-ethanol E85 quadruples oil efficiency again
  - Biofuels can make driving a way to protect, not harm, the climate
- A good plug-in hybrid (such as Toyota is to road-test Nov 07 and may sell in MY08) redoubles fuel efficiency again, and could be attractive if the power grid buys its electric storage function via a "smart garage"
  - Precursor of "vehicle-to-grid" fuel-cell play—power plant on wheels
  - So far, these stages can save 97% of the oil/km used today
- Hydrogen fuel cells also compete via cheaper ¢/km and 2–6× less CO_2/km (or zero CO_2 if renewable)

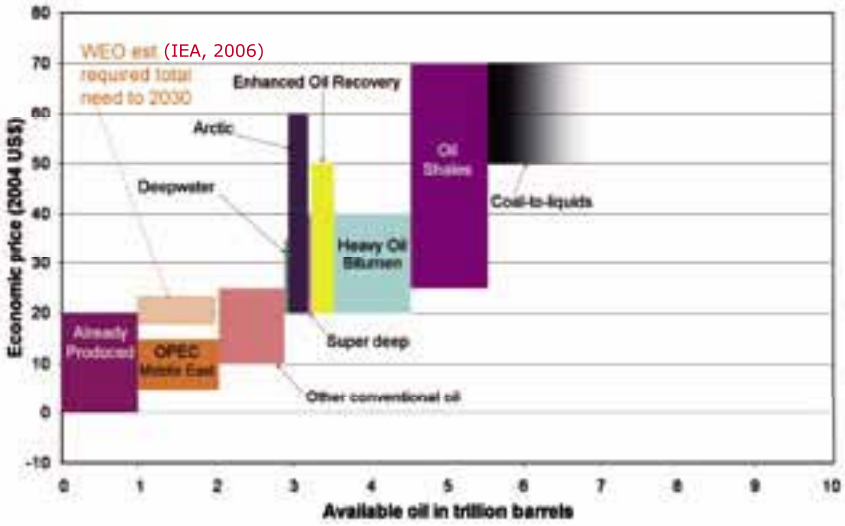
slide 37

Big, fast changes are possible

- US automakers switched in **six years** in '20s from 85% open wood bodies to 70% closed steel bodies—and in **six months** from making 4 million light vehicles/y to making the weapons and munitions that won World War II
- In **eight years**, 1977–85, US cut oil/GDP by 5.2%/y—equivalent, at a given GDP, to a Gulf every 2.5 years; the 47% (4.9%/y) gain in new US-made cars was the key
- Boeing launched *787* 4/04, scheduled in-service 5/08—built on prior work, but still all in the lab in 03; so a very complex and highly regulated product was transformed in **four years**
- GM's small team took *EV1* launch-to-street in three years
- Major technological transformations take **12–15 years** to go from 10% to 90% adoption in the product stock, but innovative business strategies and public policies can get to the first 10% years earlier, & greatly steepen adoption curve

slide 38

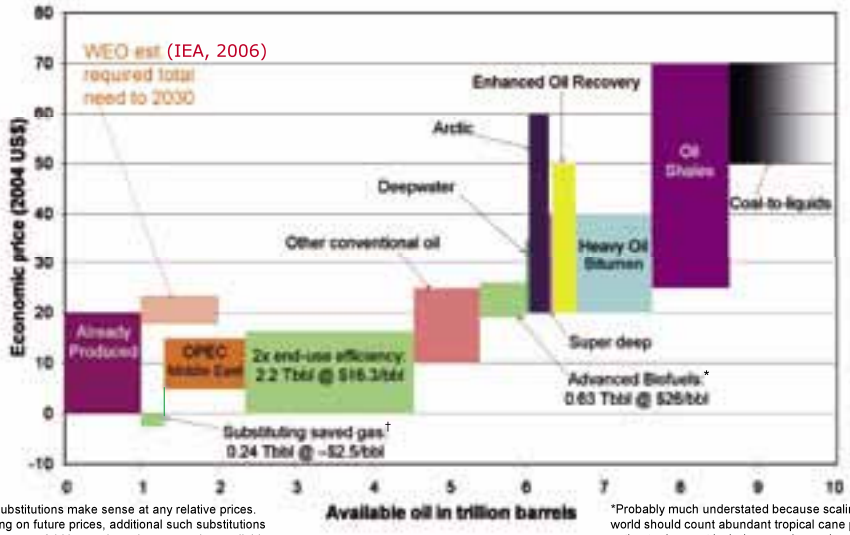
The oil industry's conventional wisdom: approximate long-run supply curve for world crude oil and substitute fossil-fuel supplies



Source: BP data as graphed by USDoD JASON, "Reducing DoD Fossil-Fuel Dependence" (JSR-06-135, Nov. 2006, p. 6, www.fas.org/irp/agency/dod/jason/fossil.pdf), plus (red crosshatched box) IEA's 2006 *World Energy Outlook* estimate of world demand and supply to 2030, plus (black/gray) RMI's coal-to-liquids (Fischer-Tropsch) estimate derived from 2006–07 industry data and subject to reasonable water constraints. This and following graphic were redrawn by Imran Sheikh (RMI)

slide 39

How that supply curve stretches ~3 Tbbl if the U.S. potential shown in *Winning the Oil End-game* scales, very approximately, to the world



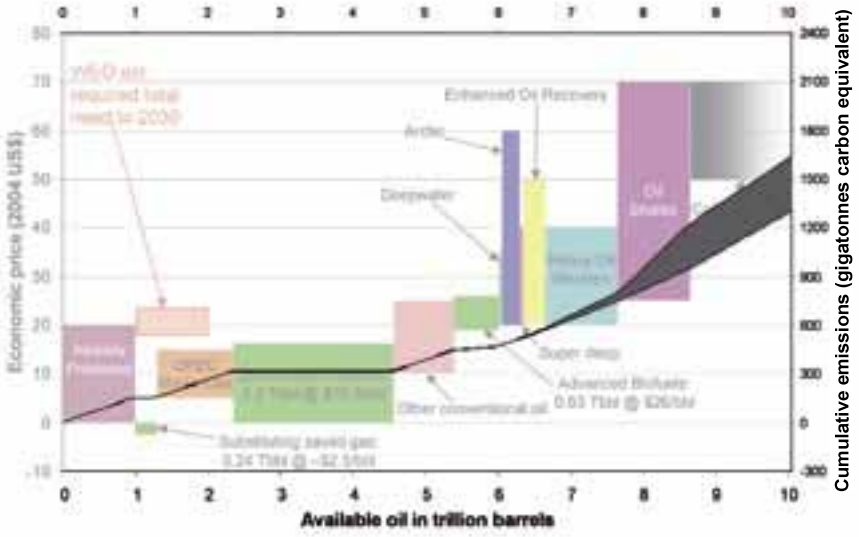
†These substitutions make sense at any relative prices. Depending on future prices, additional such substitutions several- to manyfold larger than shown are also available

*Probably much understated because scaling from U.S. to world should count abundant tropical cane potential; also, the estimate does not include emerging major options like algal oils

To scale from U.S. alternatives-to-oil potential in Mbbl/d achievable by the 2040s (at average cost $16/bbl in 2004 $: www.oilendgame.com) to world potential over 50 y, multiply the U.S. Mbbl/d × 146,000: 365 d/y × 50 y × 4 (for U.S.→world market size) × 2 (for growth in services provided). Obviously actual resource dynamics are more complex and these multipliers are very rough, so **this result is only illustrative and indicative.**

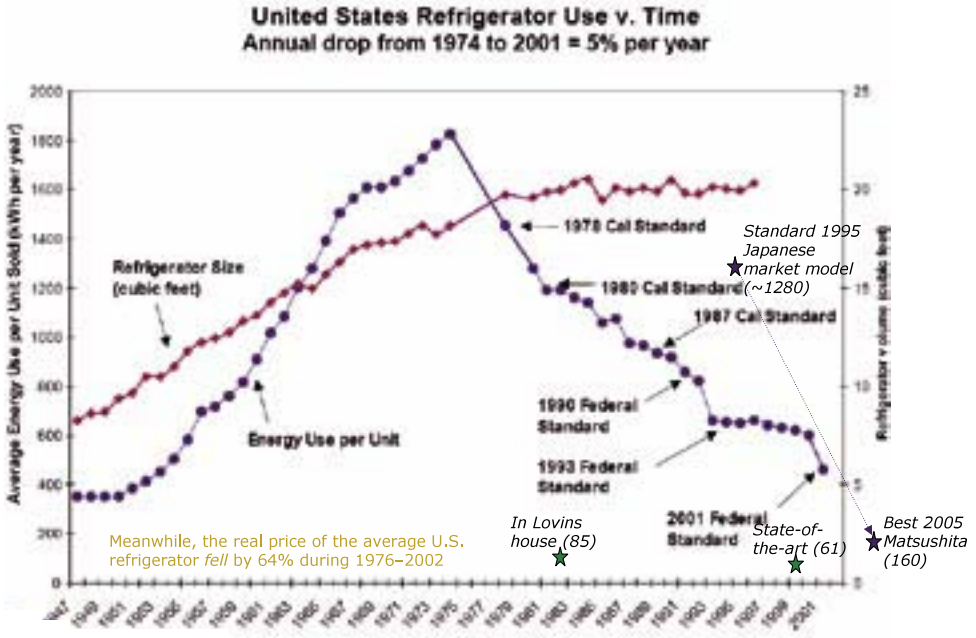
slide 40

Stretching oil supply curve ~3 Tbbl averts >1 trillion tonnes of carbon emissions



slide 41

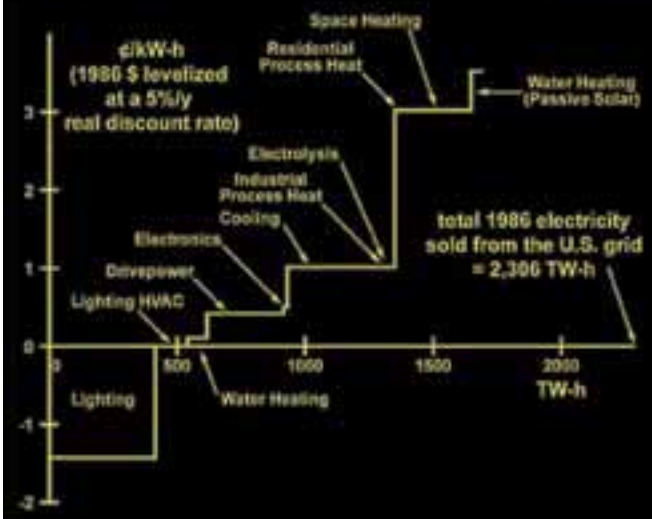
Efficiency is a rapidly moving target



Japan's standards aim to cut el. use 30% from ~1997 levels for refrigerators, 16% for TVs, 83% for PCs, 14% for air conditioners,…; all can go much lower

slide 42

1989 supply curve for saveable US electricity (*vs.* 1986 frozen efficiency)



Best 1989 commercially available, retrofittable technologies

EPRI found 40–60% saving 2000 potential; difference was largely methodological

Similar S, DK, D, UK…

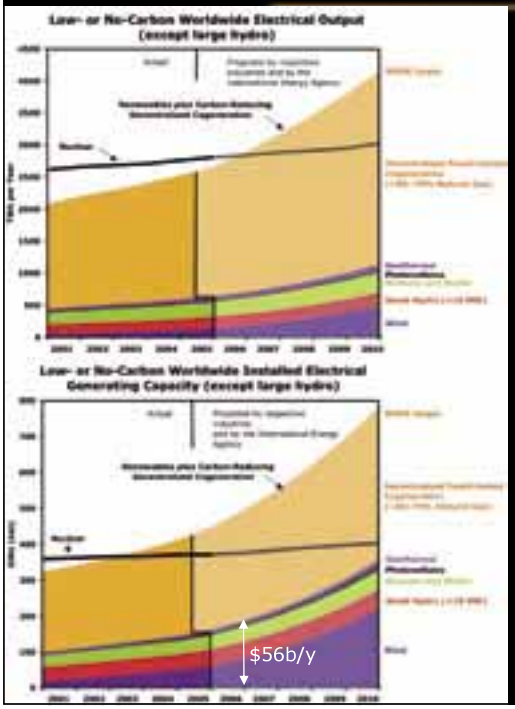
Savings get bigger & cheaper faster than they're being depleted

Measured technical cost and performance data for ~1,000 technologies (RMI 1986–92, 6 vol, 2,509 pp, 5,135 notes)

slide 43

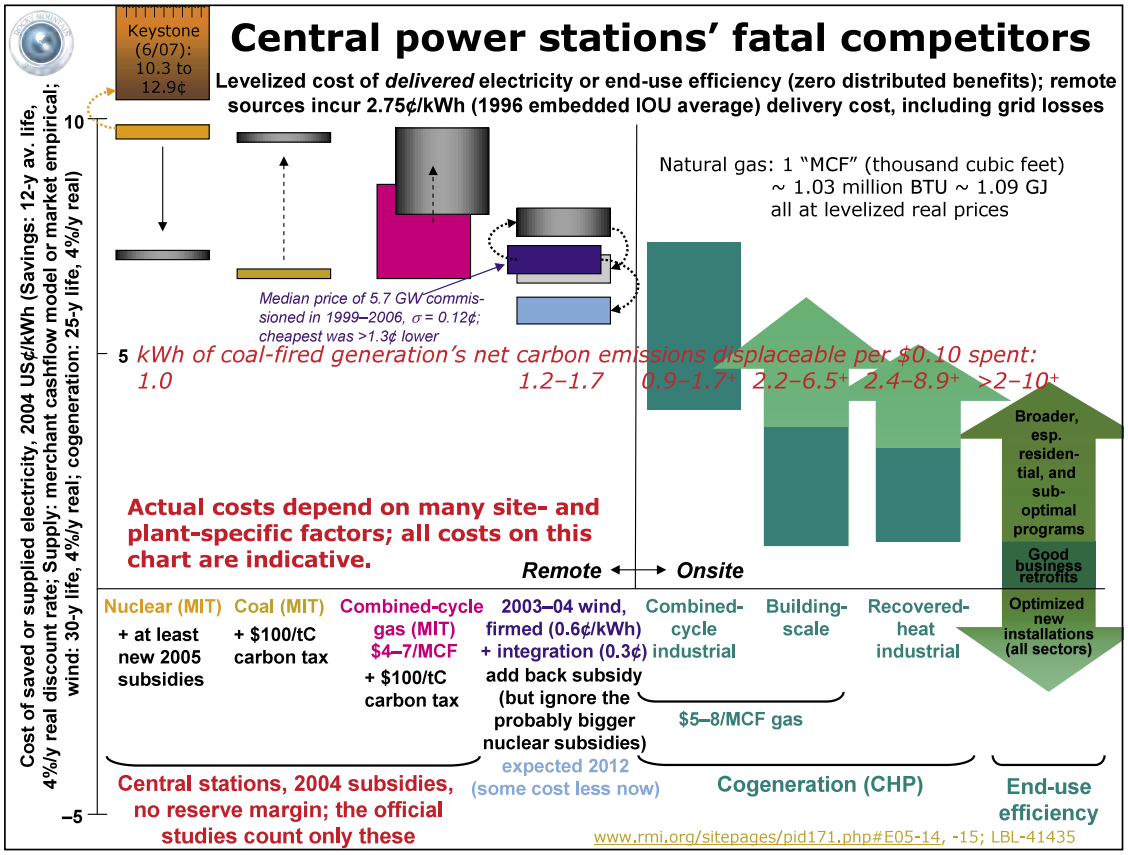
Electric shock: low-/no-carbon decentralized sources are eclipsing central stations

RMI analysis: www.rmi.org/sitepages/pid171.php#E05-04

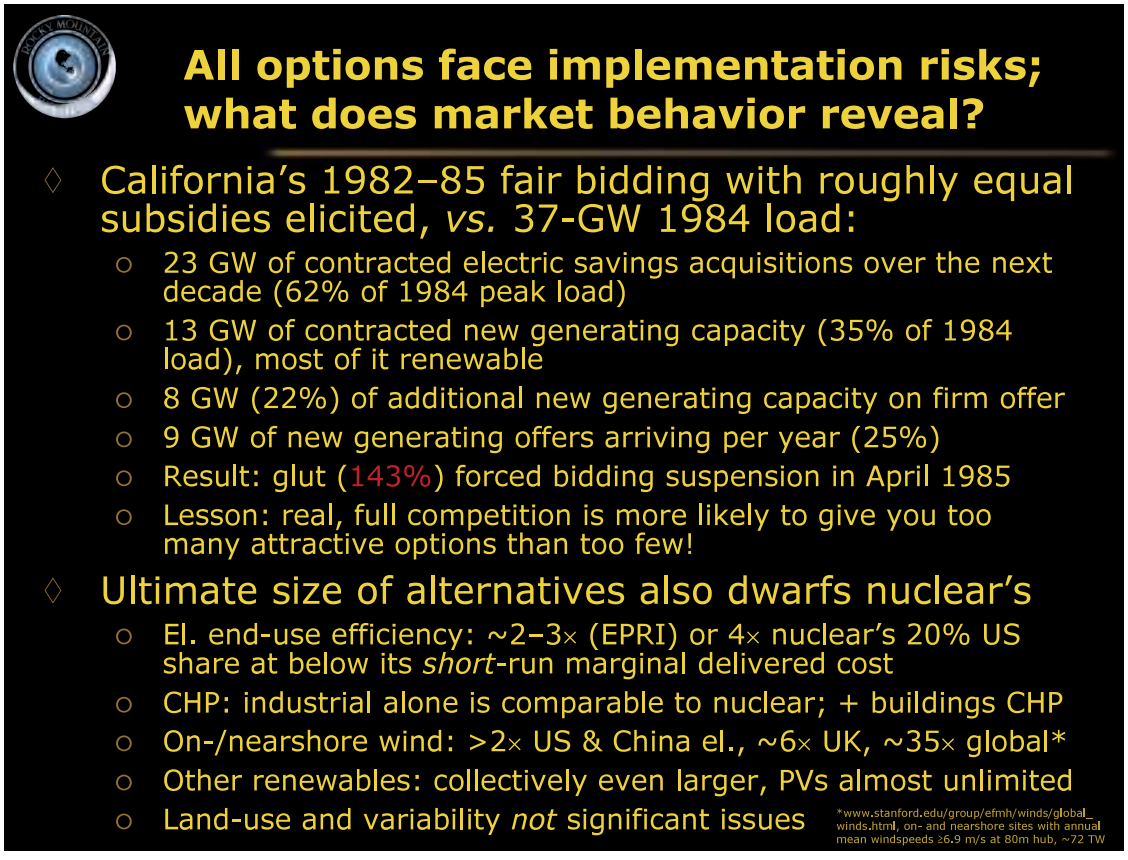


- Two-thirds combined-heat-and-power (cogeneration)*, ~60–70% gas-fired, ≥50% CO_2 reduction
  *Gas turbines ≤120 MWe, engines ≤30 MWe, steam turbines only in China
- One-third renewable (including hydropower only up to 10 MW_e)
- *1/6 of global el, 1/3 of <u>new</u> el*
- 1/6 to >1/2 of all electricity in 13 industrial nations
- Negawatts appear comparable
- In 2005, these low- or no-carbon electricity generators added 4× as much output and 11× (excl peaking & standby units, 8×) as much global capacity as nuclear power added
- Micropower is winning due to lower costs & financial risks, so it's financed mainly by private capital (only central planners buy nuclear)

slide 44



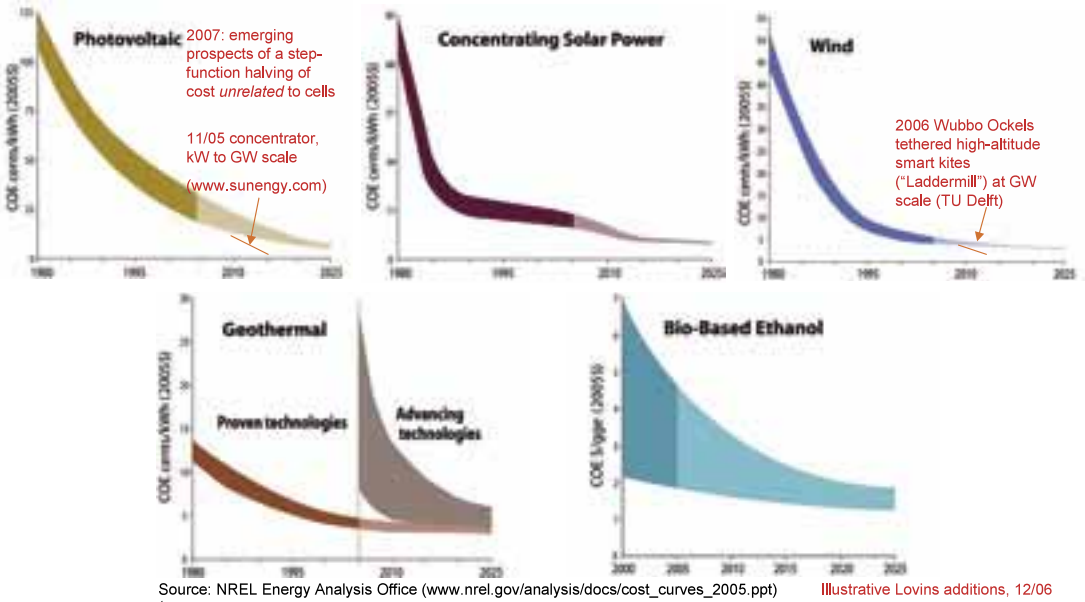
slide 45



slide 46

Renewable Energy Cost Trends

Levelized sent-out cost of energy in constant 2005 US$, excluding subsidies[1]



Source: NREL Energy Analysis Office (www.nrel.gov/analysis/docs/cost_curves_2005.ppt) Illustrative Lovins additions, 12/06

[1]These graphs are reflections of historical cost trends NOT precise annual historical data. DRAFT November 2005

NB: **These graphs, and the previous cost comparisons, *ignore* the 207 "distributed benefits" that typically increase decentralized resources' value by ~10×…as markets are starting to recognize**

slide 47

Bundling PVs with end-use efficiency: a recent example

- Santa Rita Jail, Alameda County, California
- PowerLight 1.18 MW_p project, 1.46 GWh/y, 1.2 ha of PVs
- Integrated with Cool Roof and ESCO efficiency retrofit (lighting, HVAC, controls, 1 GWh/y)
- Energy management optimizes use of PV output
- Dramatic (~0.7 MW_p) load cut
- Gross project cost $9 million
- State incentives $5 million
- Gross savings $15 million/25 y
- IRR >10%/y (Cty. hurdle rate)
- Works for PVs, so should work better for anything cheaper

slide 48

These market shifts are good for climate and security

Lovins *et al.*, *Foreign Affairs*, Summer 1980; Lovins, *Nucl. Eng. Intl.*, Dec. 2005

- Micropower and efficiency profitably protect climate
- Free up money & attention for superior alternatives, with ~10,000× capital leverage to fund development; can provide energy for a decent life, for all, for ever
- Turn energy from a source of conflict to a peace path
- Change energy systems from brittle to resilient
- Stop the main facilitator, and source of disguise, for the spread of nuclear bombs (N. Korea, Iran,…)
  - Nuclear power makes widely and innocently available all the key ingredients of do-it-yourself bomb kits; new reactor types are worse
  - Without nuclear power, these ingredients would be harder to get, more conspicuous to try to get, and politically far costlier to be caught trying to get, because the reason for wanting them would be *unambiguously* military—no more pretenses of civilian purpose
  - Without nuclear commerce, proliferation is harder and more visible
  - Another way Japanese and US leadership can create a safer world

slide 49

Japan's energy achievements and opportunities

- Industrial efficiency ranges from #1 to more ordinary; even the best can improve markedly
- But 1970– transport & residential energy use more than doubled; trucks 2×, passenger cars >6×
- Car/truck fleet efficiency far below best exports; another ≥2× is available quickly at no extra cost
- Building efficiency unimpressive; needs mass retrofits, fully integrated new equipment & design
- Some excellent policies like "Top Runner", but need comprehensive barrier-busting, not just price
- Key: reward energy distributors not for selling more energy but for cutting customers' bills
- Japan is poor in fuels but rich in energy
- Biggest barrier: not realizing that opportunities for both efficiency and renewables are very large

slide 50


We are the people we have been waiting for.
Japan is the leader the world is waiting for.
"Only puny secrets need protection.
Great discoveries are protected
by public incredulity."
—Marshall McLuhan
Your move…
www.oilendgame.com,
www.fiberforge.com,
www.rmi.org
(Publications),
www.natcap.org
ご静聴ありがとうございます

slide 51

財団法人 旭硝子財団
〒102-0081 東京都千代田区四番町5-3 サイエンスプラザ2F
THE ASAHI GLASS FOUNDATION
2nd Floor, Science Plaza, 5-3, Yonbancho
Chiyoda-ku, Tokyo 102-0081, Japan

Phone 03-5275-0620 Fax 03-5275-0871
E-Mail post@af-info.or.jp
URL http://www.af-info.or.jp

本プログラムは再生紙を使用しています。
Printed on recycled paper.