

Class 14: Seeing Green

logistics

Assignment 4 due tonight at midnight

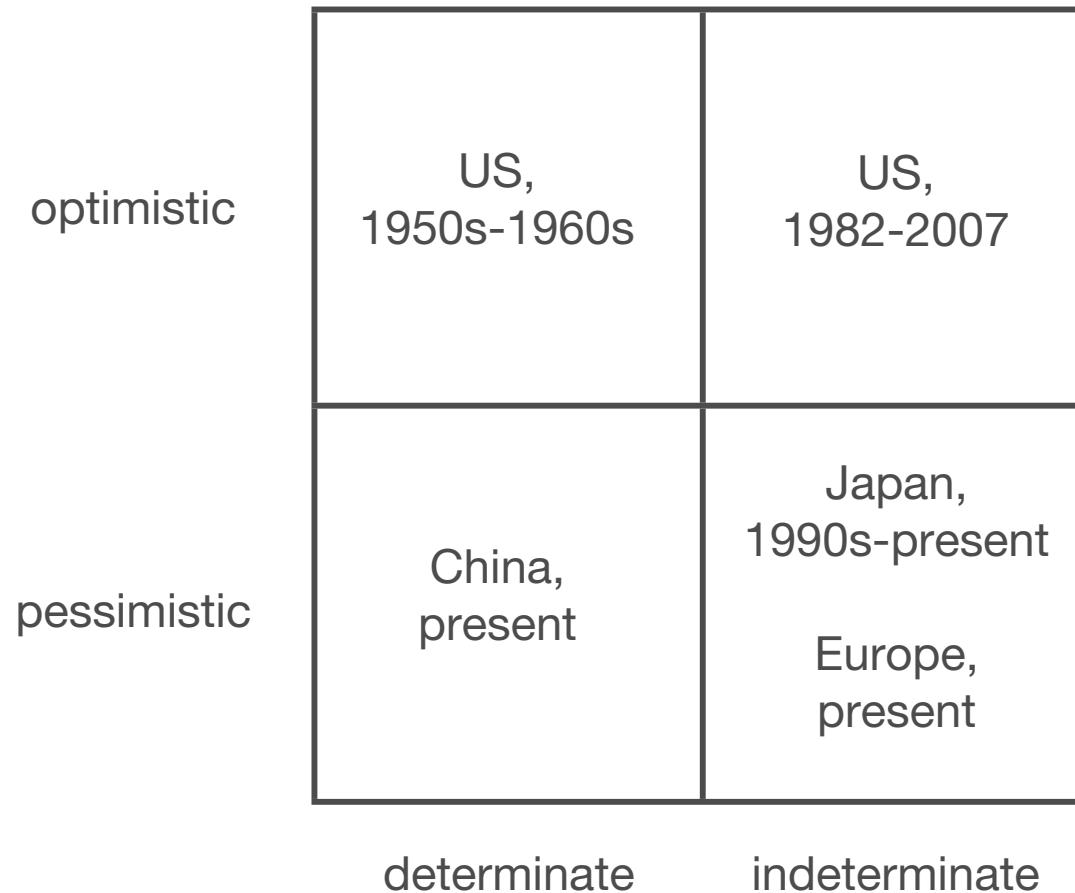
Pitch time slots on Lore tonight, with signups

Assignment 5 posted tonight

outline

1. thinking about energy
2. a brief history of energy
3. failure of cleantech
4. energy futures
5. the government question

the broader environment



applied to energy

	one specific thing that is better	portfolio of less expensive sources
optimistic		
pessimistic	conservation (rationing)	portfolio of more expensive sources
	determinate	indeterminate

the “energy” market

power generation

wood

coal

natural gas

nuclear

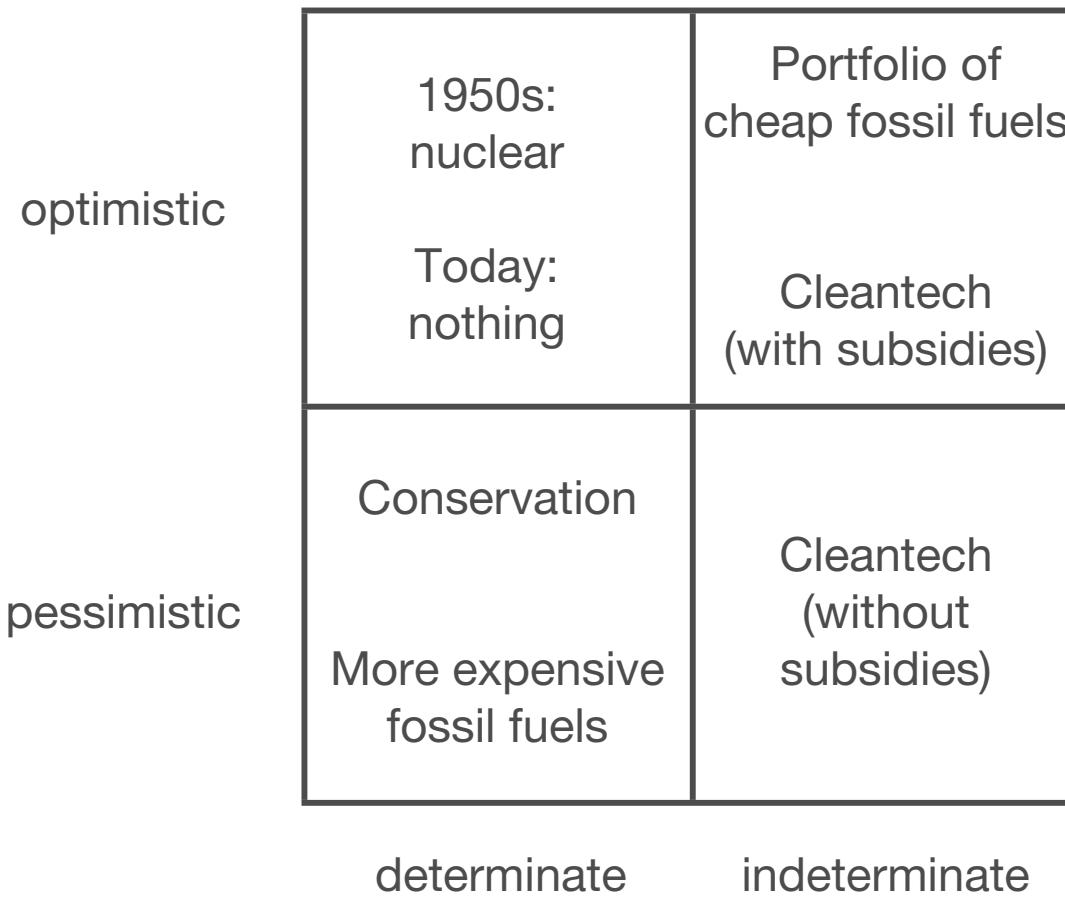
biomass, hydro, wind, solar

transportation

oil

electricity

power generation



transportation

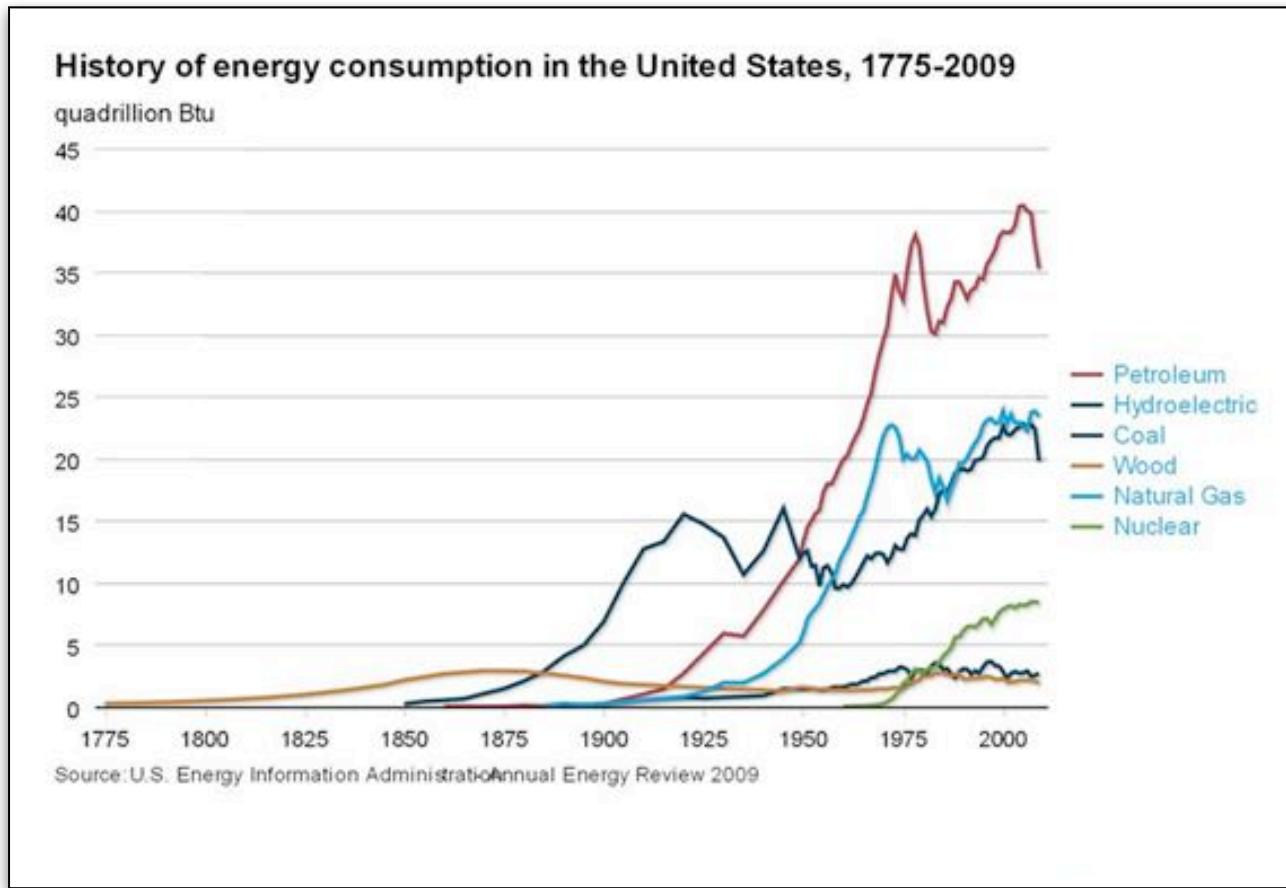
	1950s: space jets Today: nothing	Cheap oil Portfolio of storage tech, telecommuting
optimistic pessimistic	Conservation More expensive oil, high-speed rail	Smaller cars, bikes, trains, range of inferior options

determinate indeterminate

outline

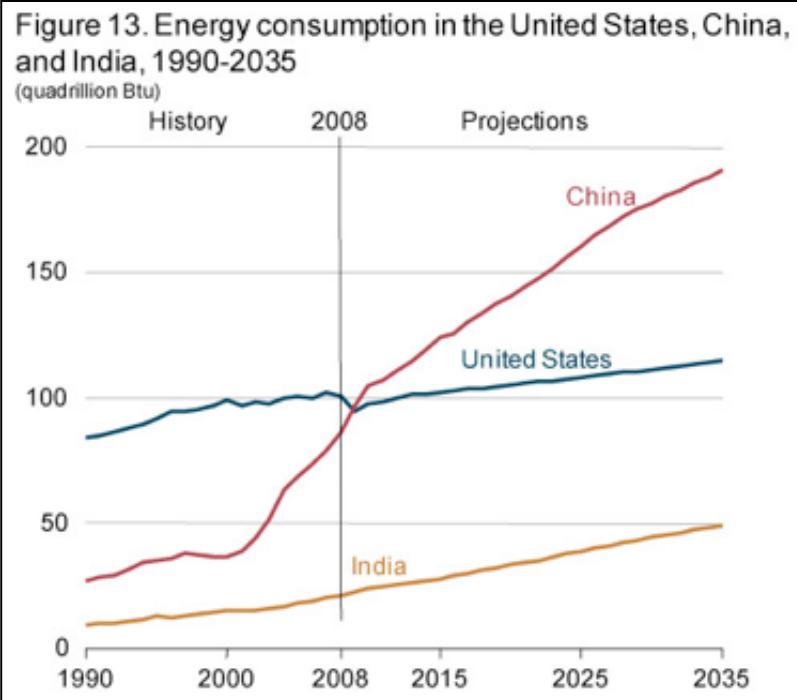
1. thinking about energy
2. a brief history of energy
3. failure of cleantech
4. energy futures
5. the government question

one source tends to dominate

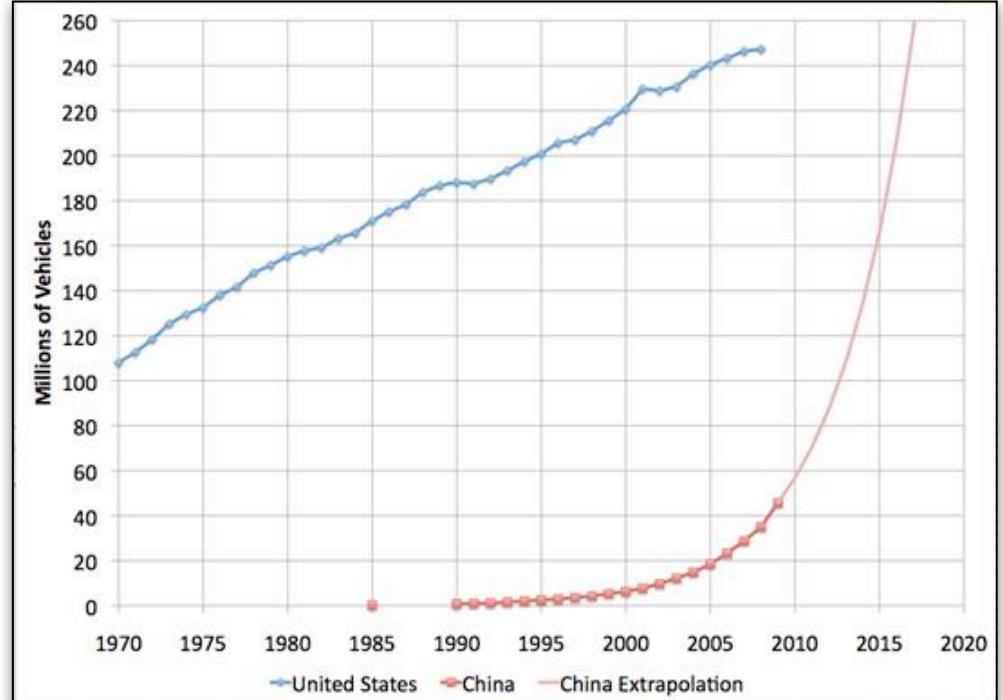


globalization

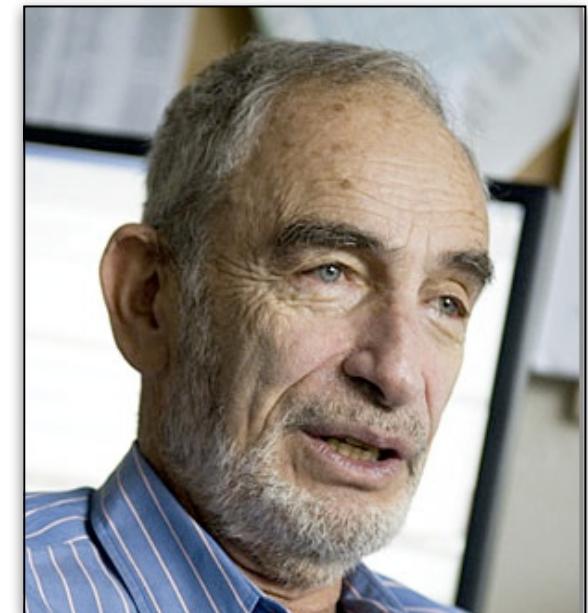
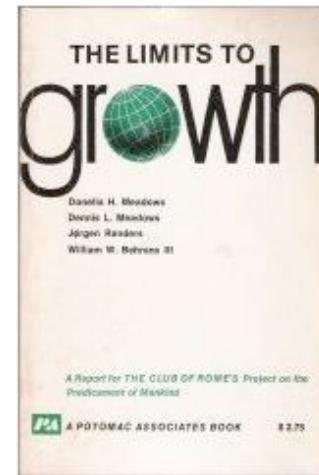
power



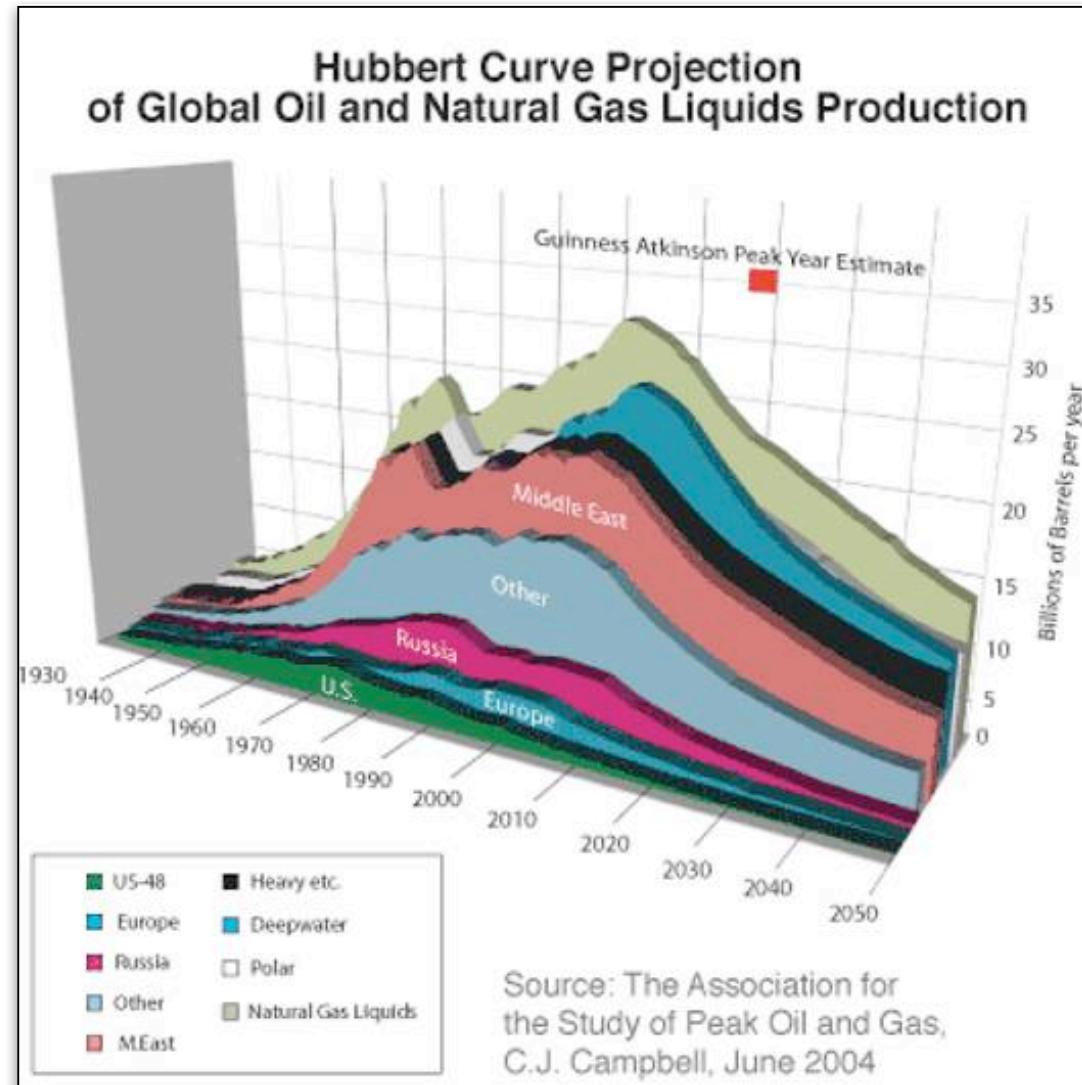
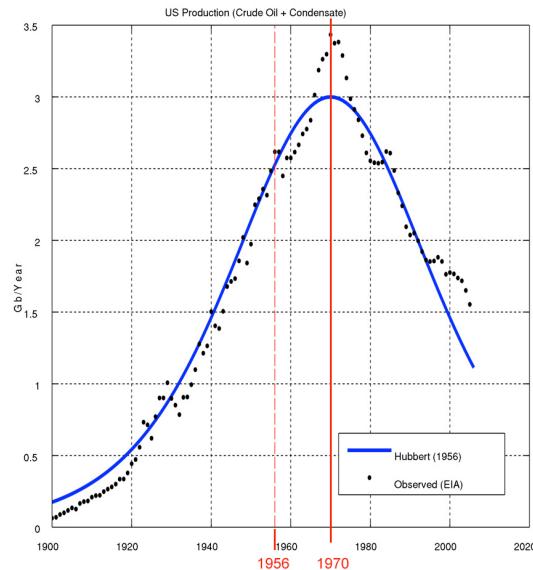
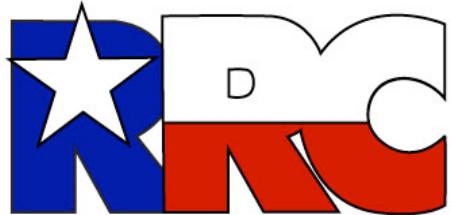
transportation



a history of concern



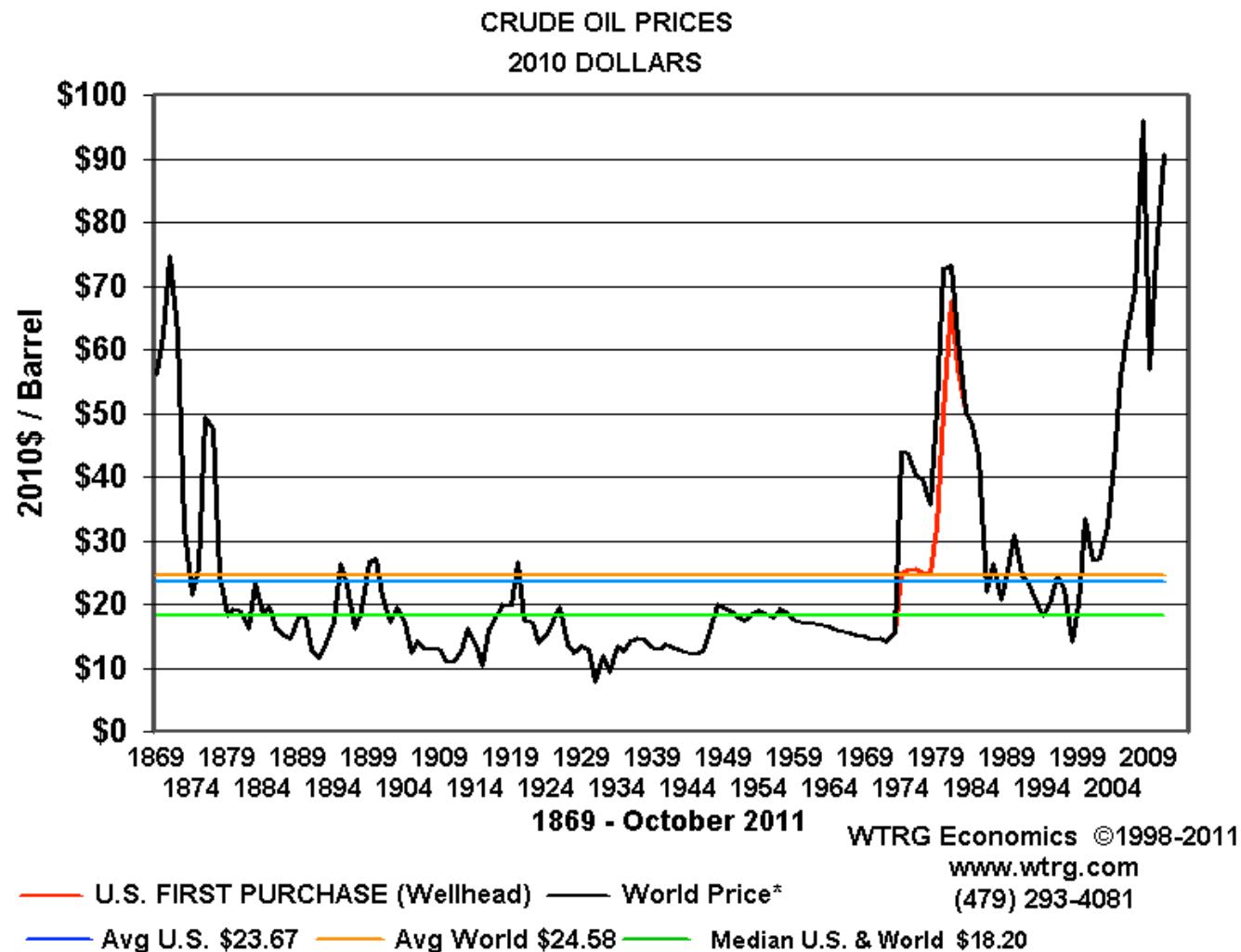
peak oil



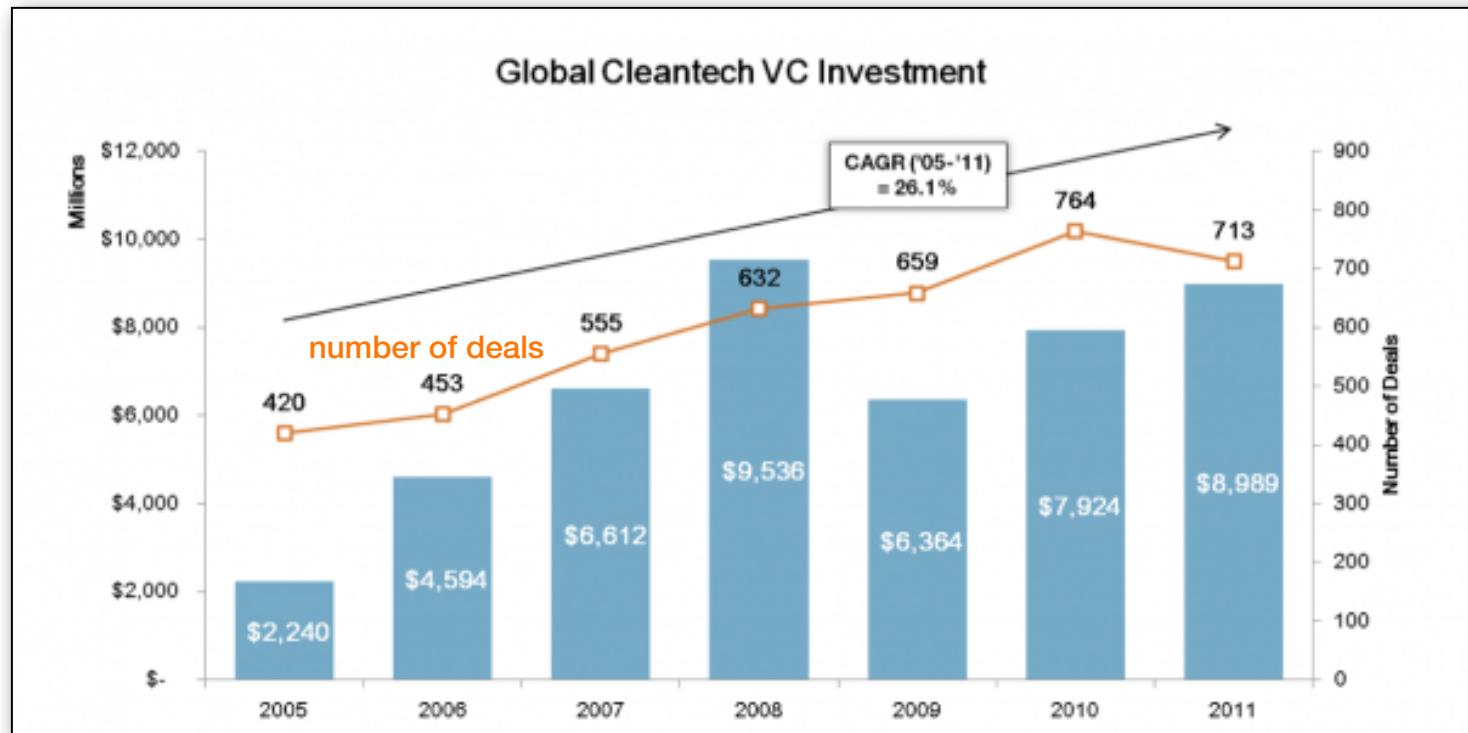
a history of entanglement



the cost of oil



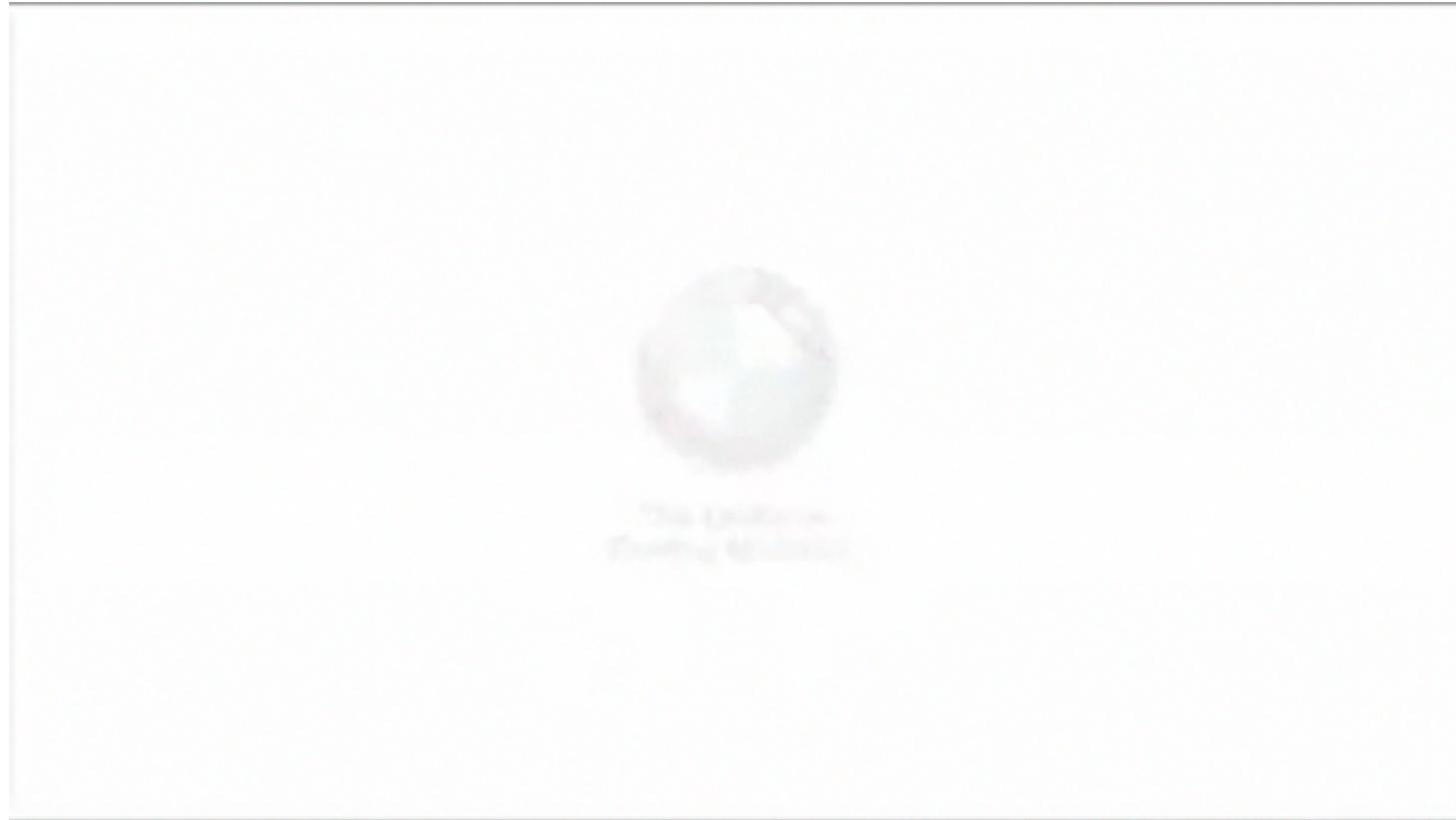
the rise of cleantech



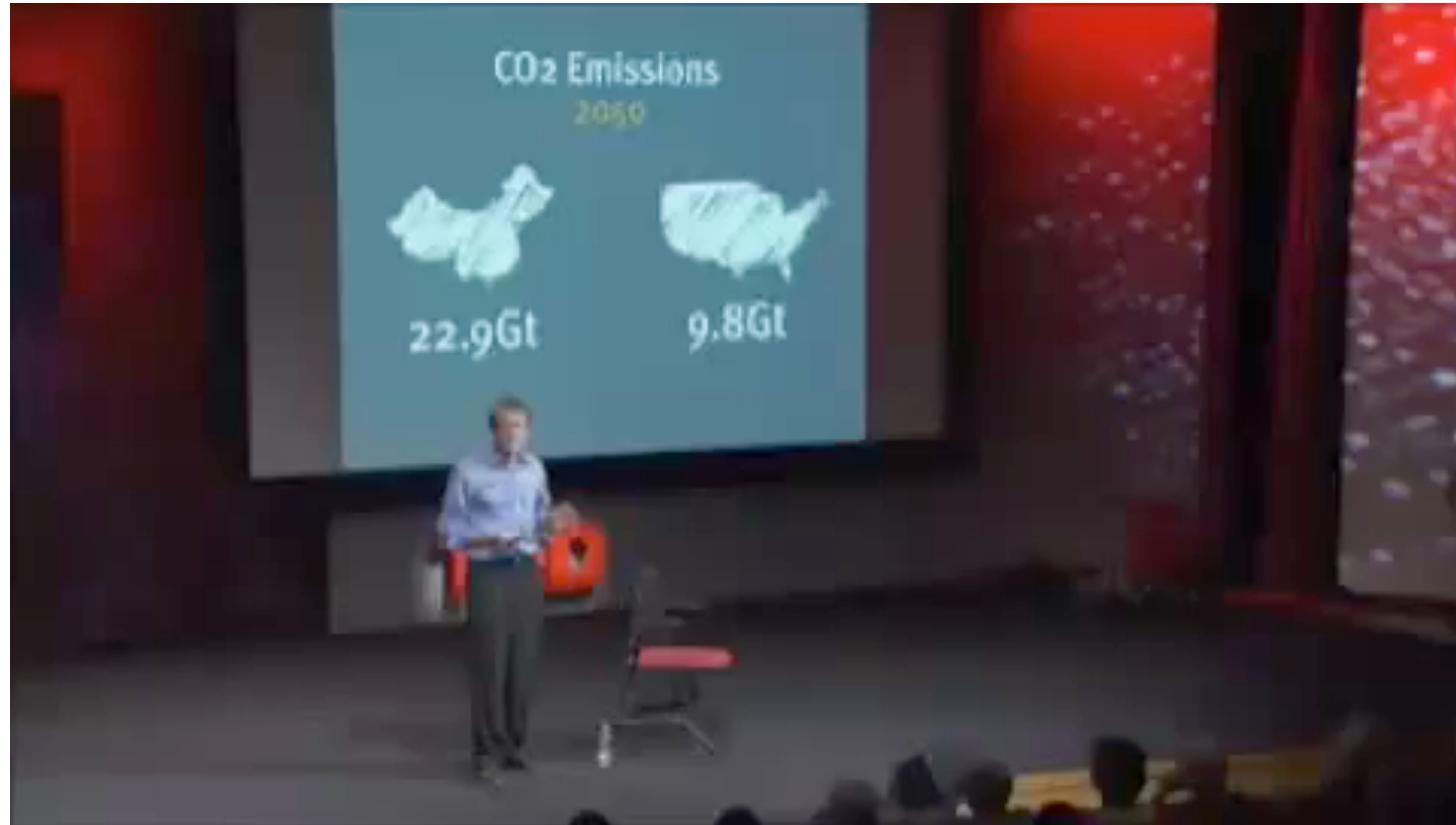
climate change



the cleantech imperative



the cleantech imperative

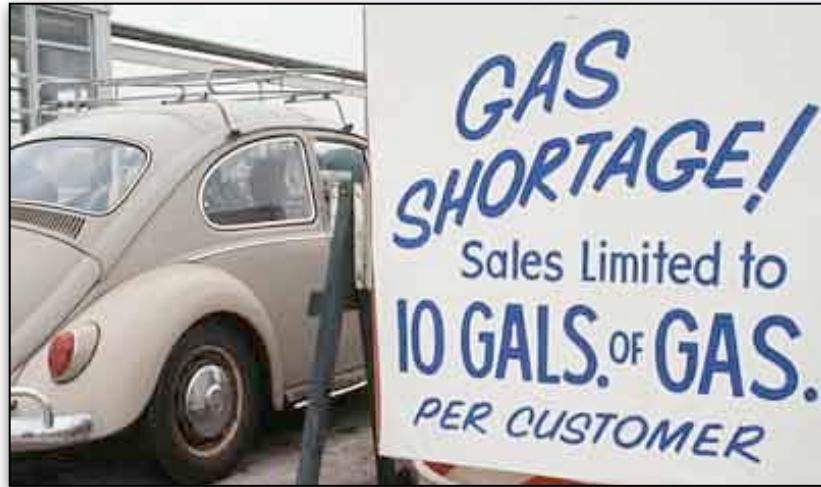


outline

1. thinking about energy
2. a brief history of energy
3. failure of cleantech
4. energy futures
5. the government question

the question of scarcity

resource



environmental



mistakes were made

markets

mimesis and competition

secrets

incrementalism

durability

teams

distribution

timing

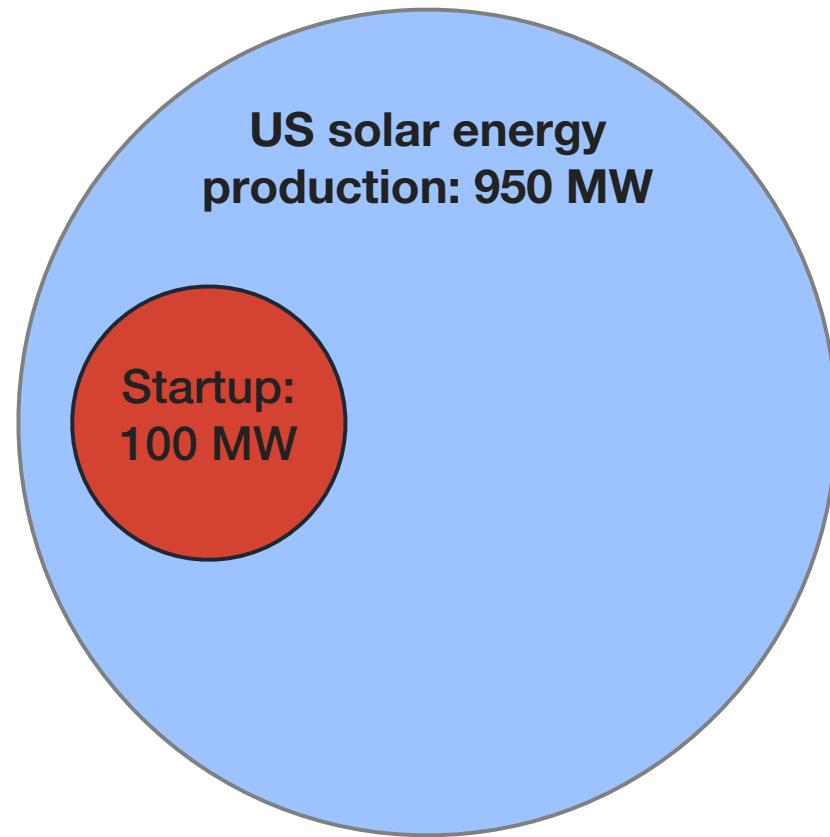
financing

luck

markets - the lies people tell

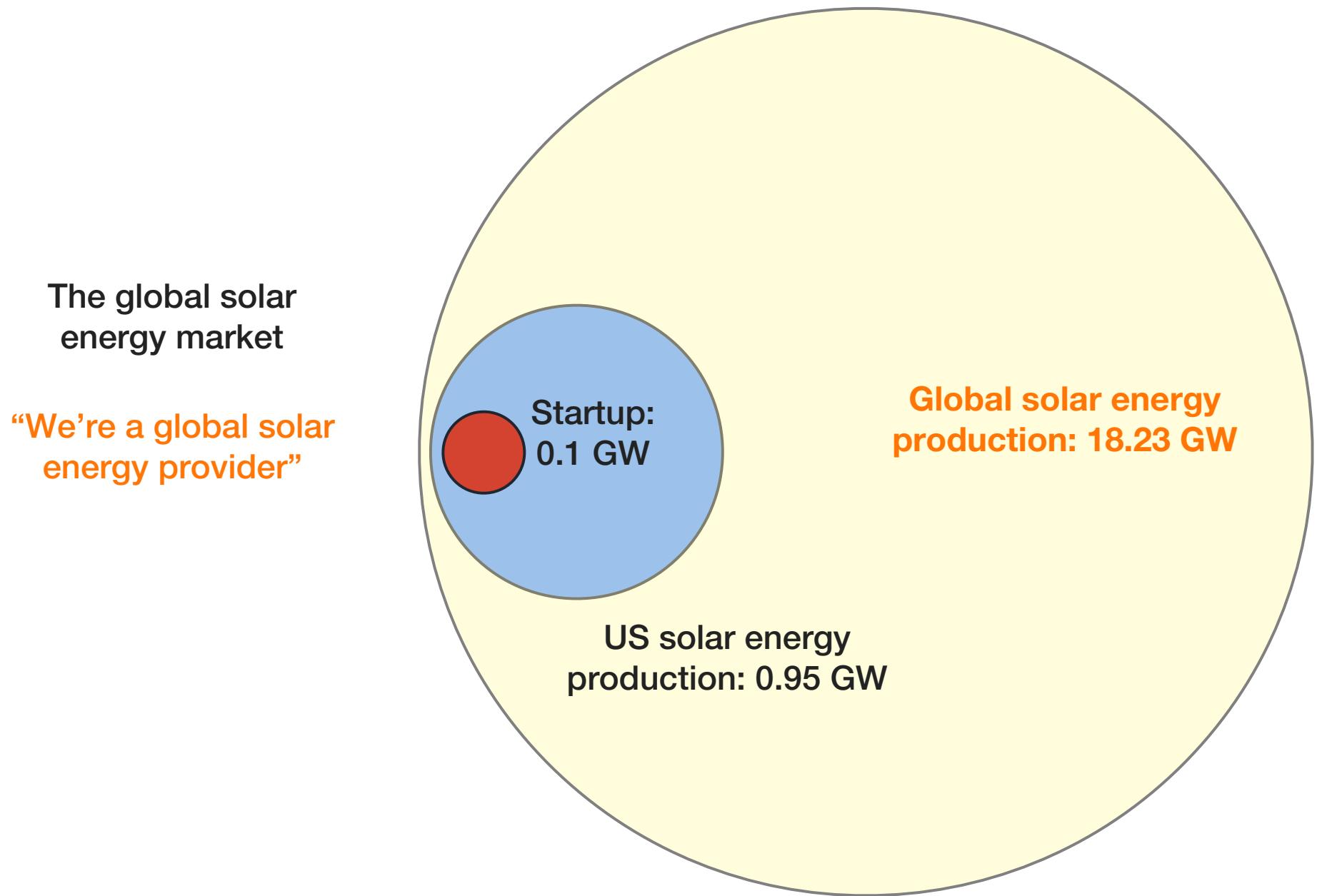
The US solar energy market

“Over 1000 systems installed...
representing over 100 MW of power”



Source: <http://www.solarbuzz.com/facts-and-figures/market-facts/global-pv-market>

markets - the lies people tell

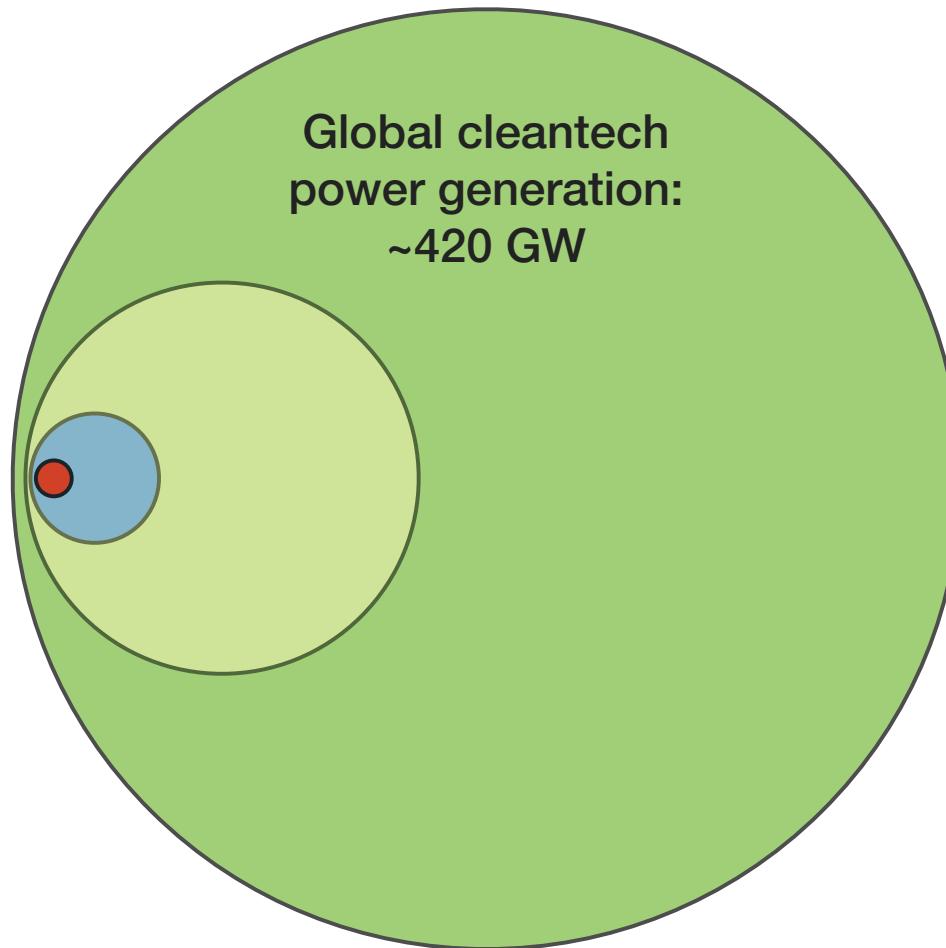


Source: <http://www.solarbuzz.com/facts-and-figures/market-facts/global-pv-market>

the cleantech market

The cleantech energy market

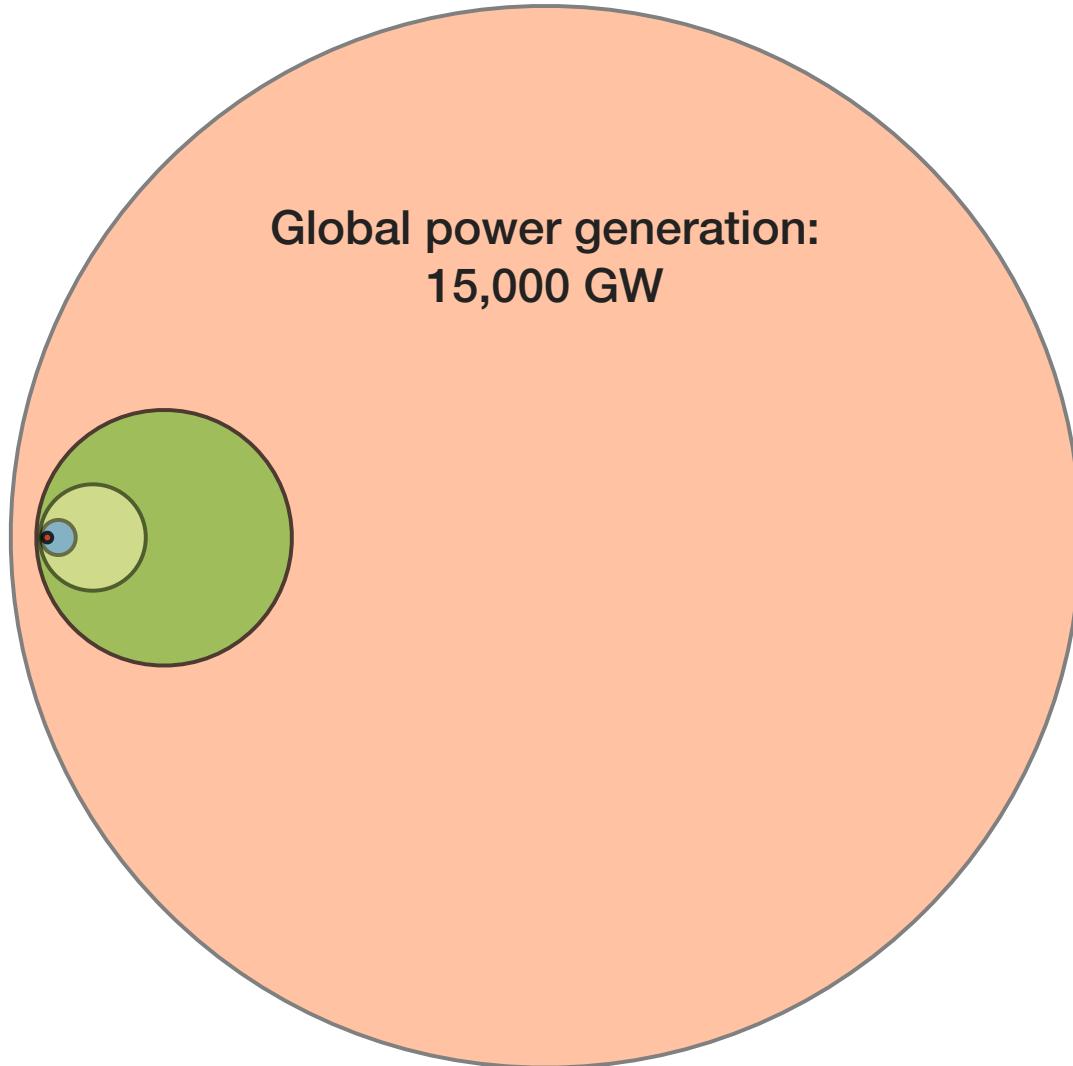
“We’re a global cleantech energy provider”



Note: includes small hydro, modern biomass, wind, solar, geothermal and biofuels

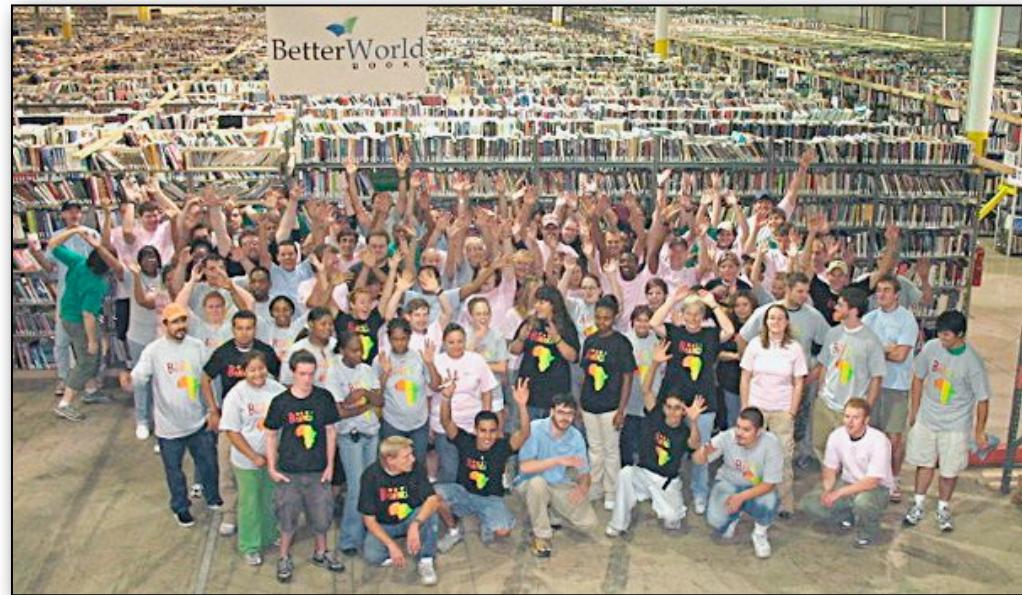
The global energy market

“We’re a global energy provider”



Source: US Energy Information Association, 2010

social entrepreneurship



mimesis and competition



mimesis and competition



mimesis and competition



mimesis and competition



small secrets

esoteric

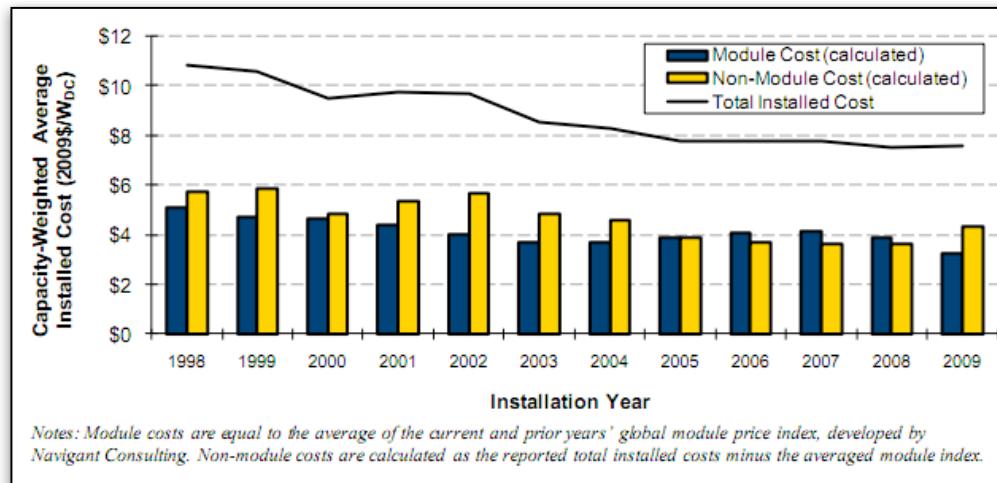
small

silly

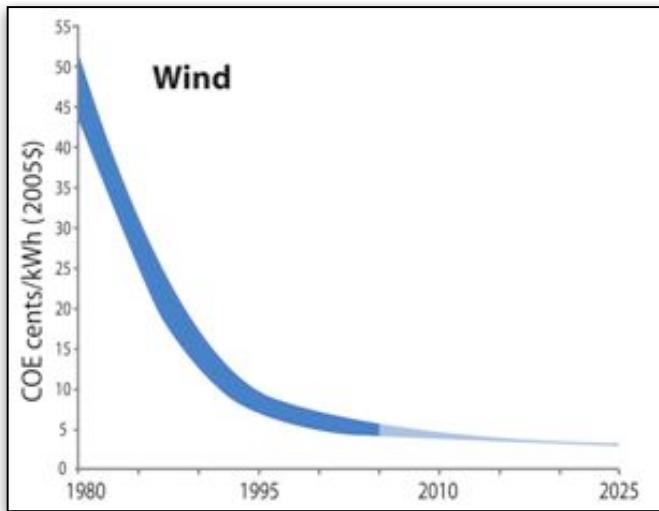
big

incrementalism

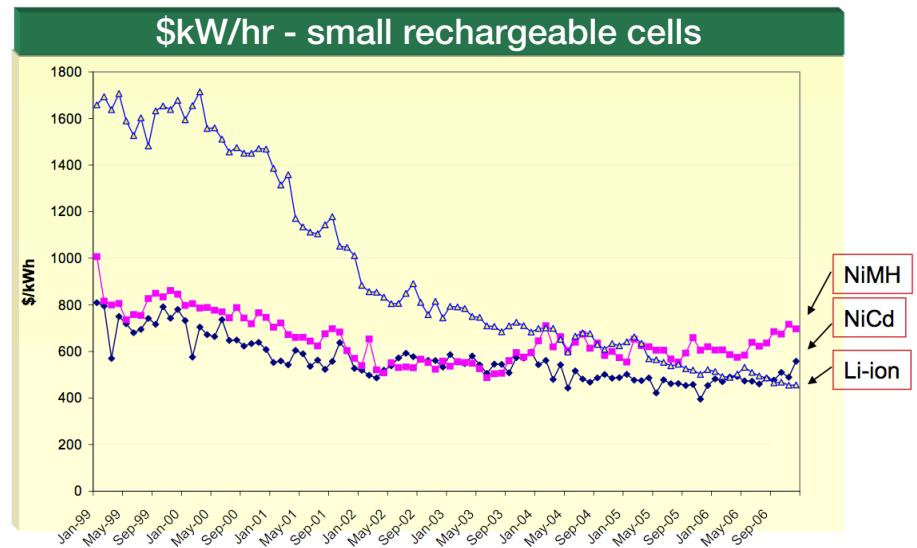
cost of solar power



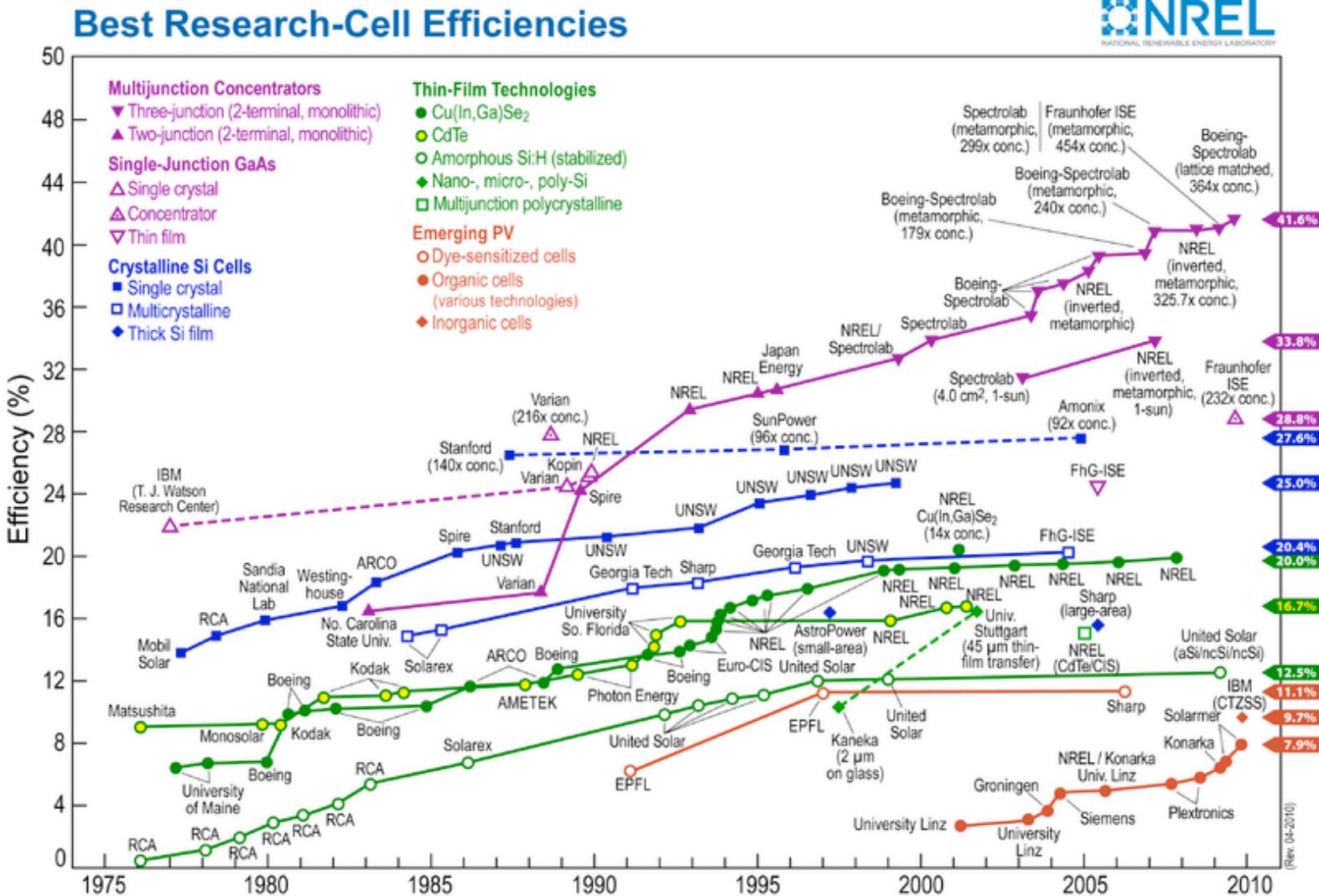
cost of wind power



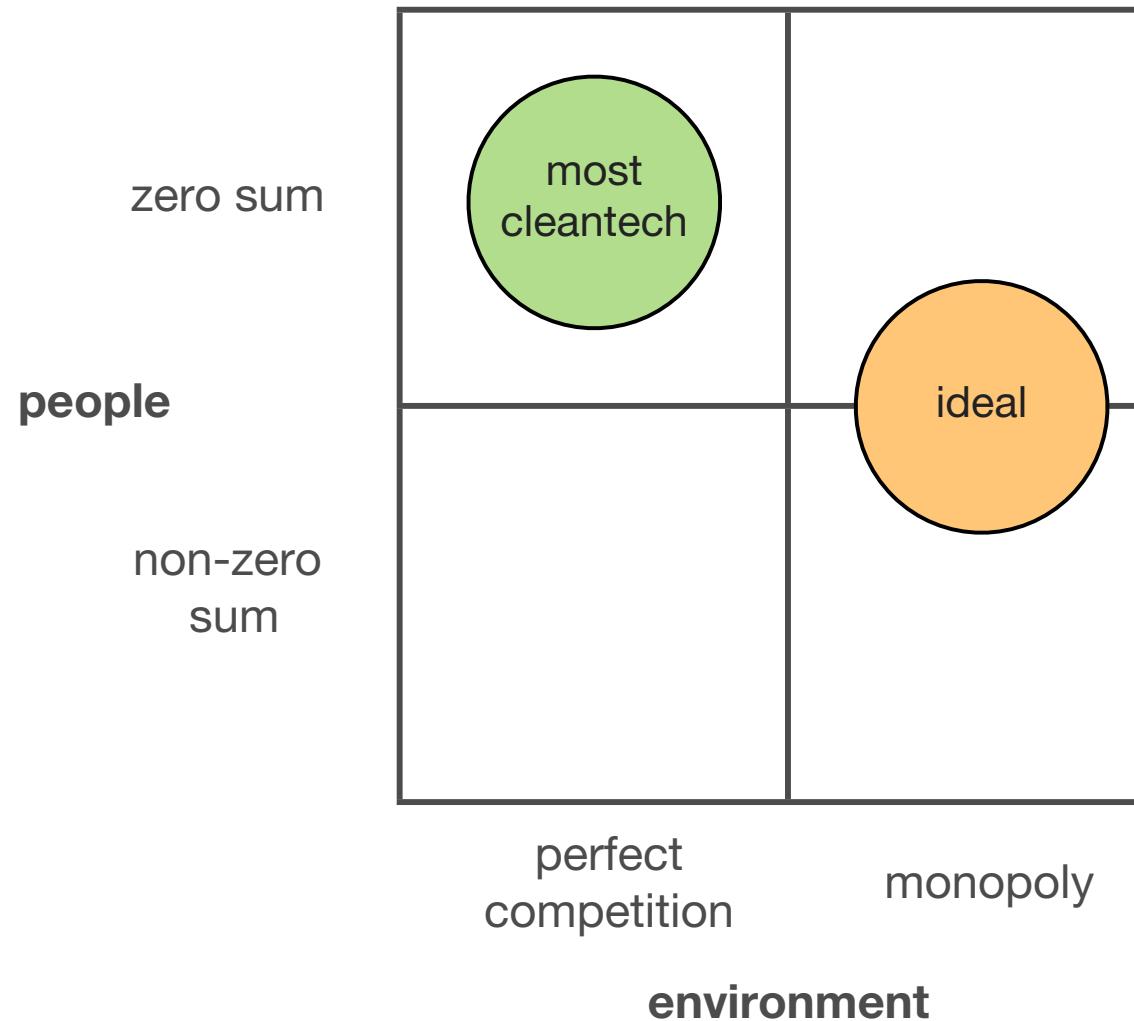
cost of storage



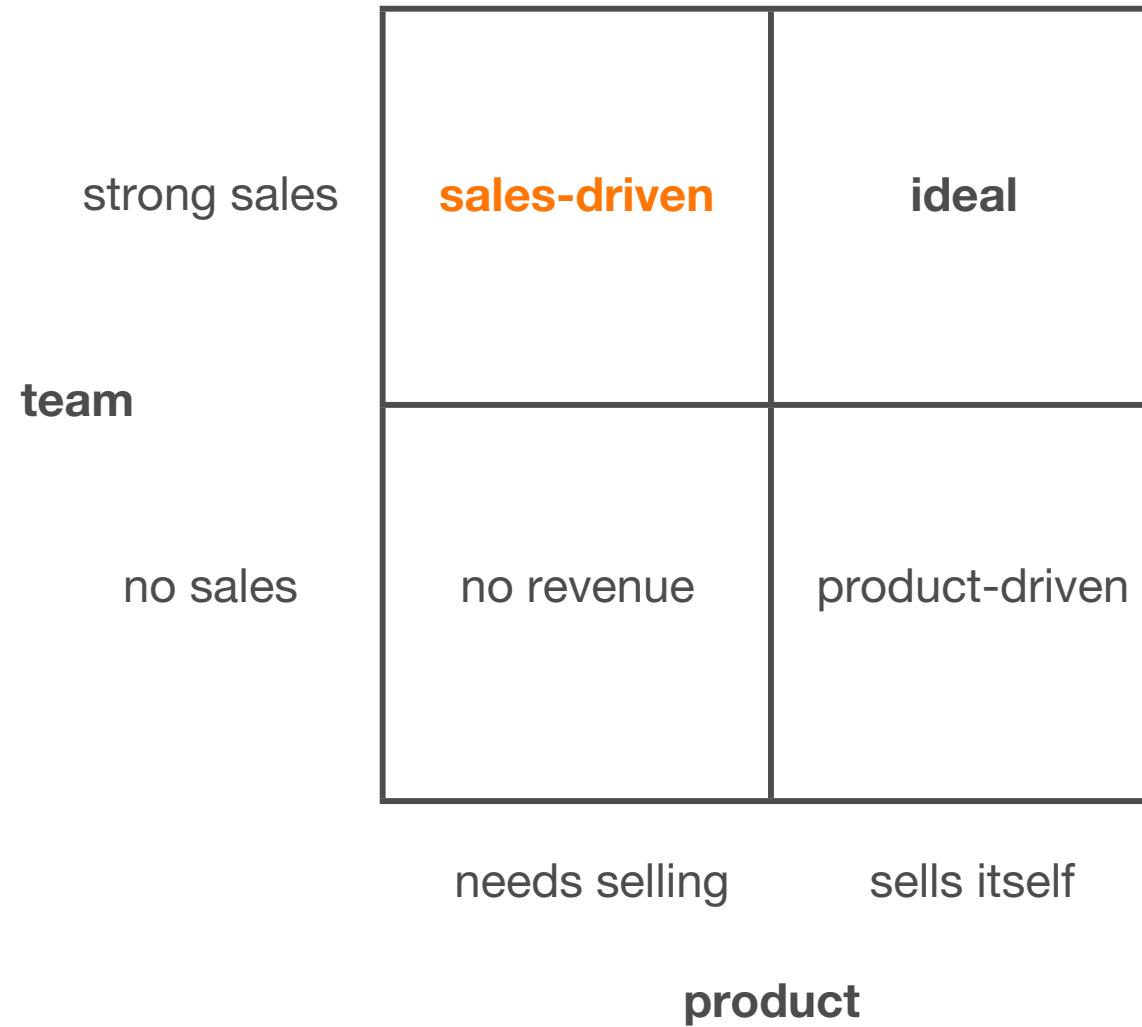
durability



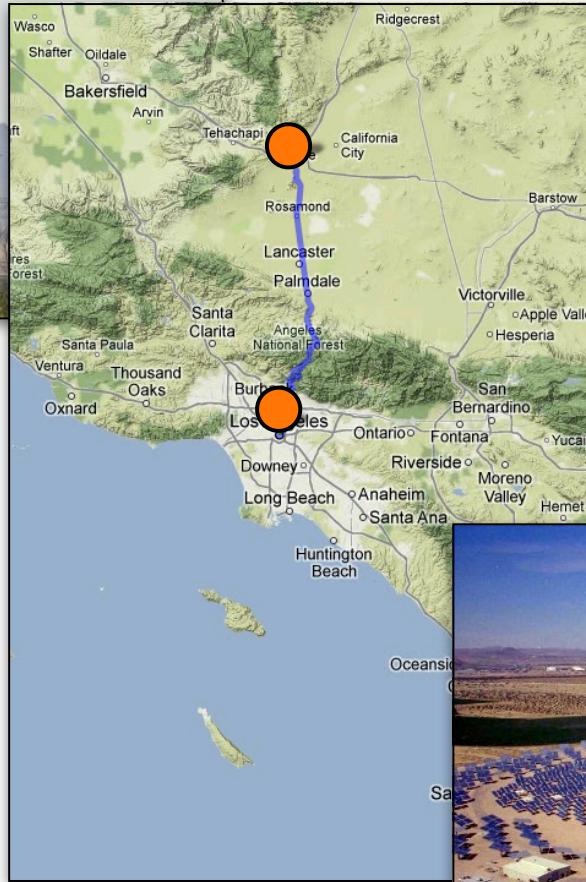
teams



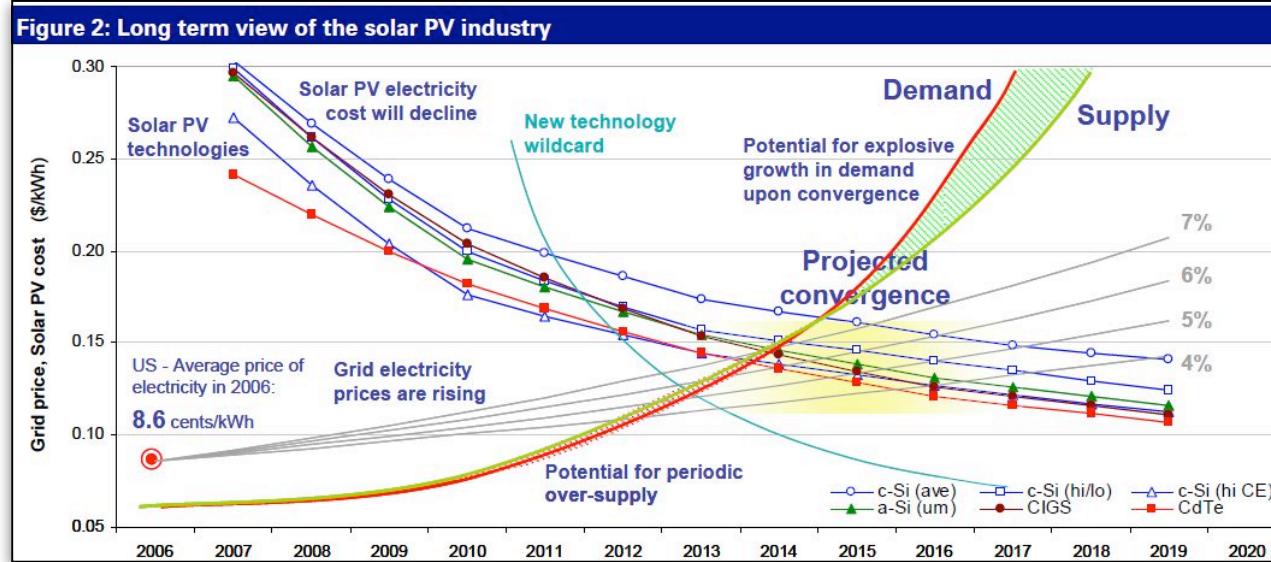
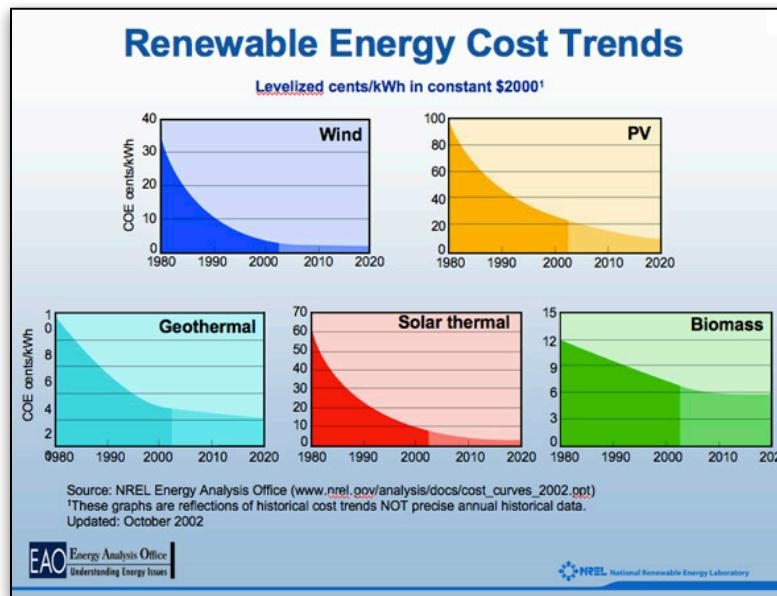
distribution



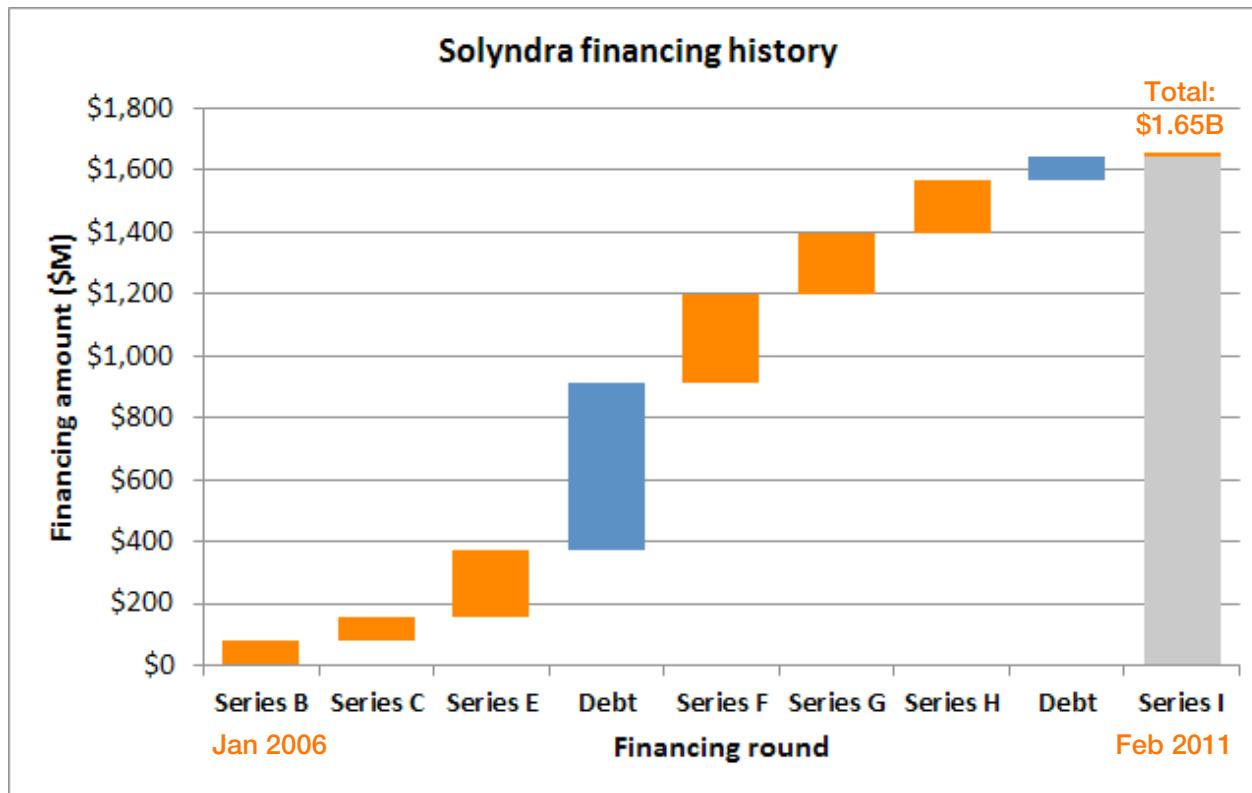
distribution, literally



timing



financing



energy and coordination

what is required

brilliant inspiration

incremental improvement

complex coordination

counting on luck

answered themselves



counting on luck

relied on others to solve

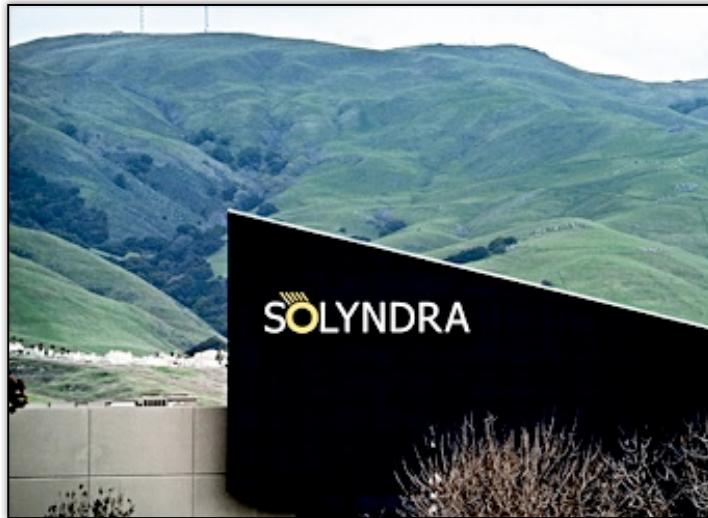


counting on luck

didn't even try to solve

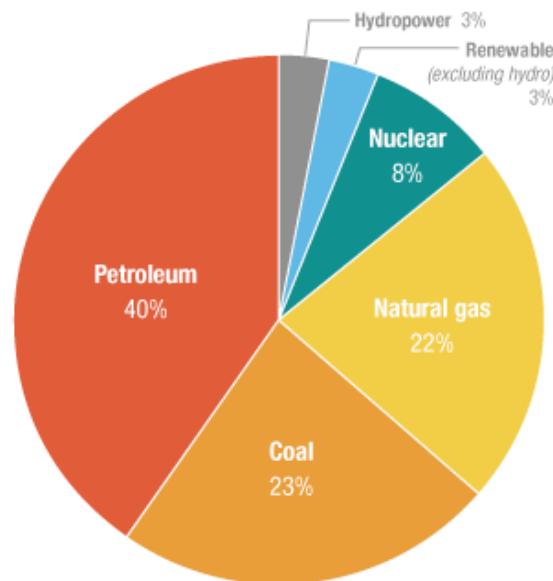


the Solyndra failure

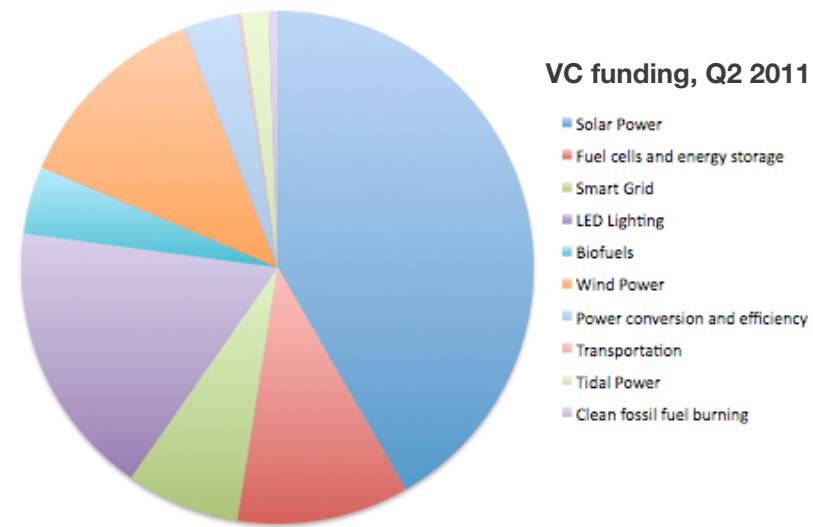


where are we now?

a small portion of energy production



invested in a portfolio approach



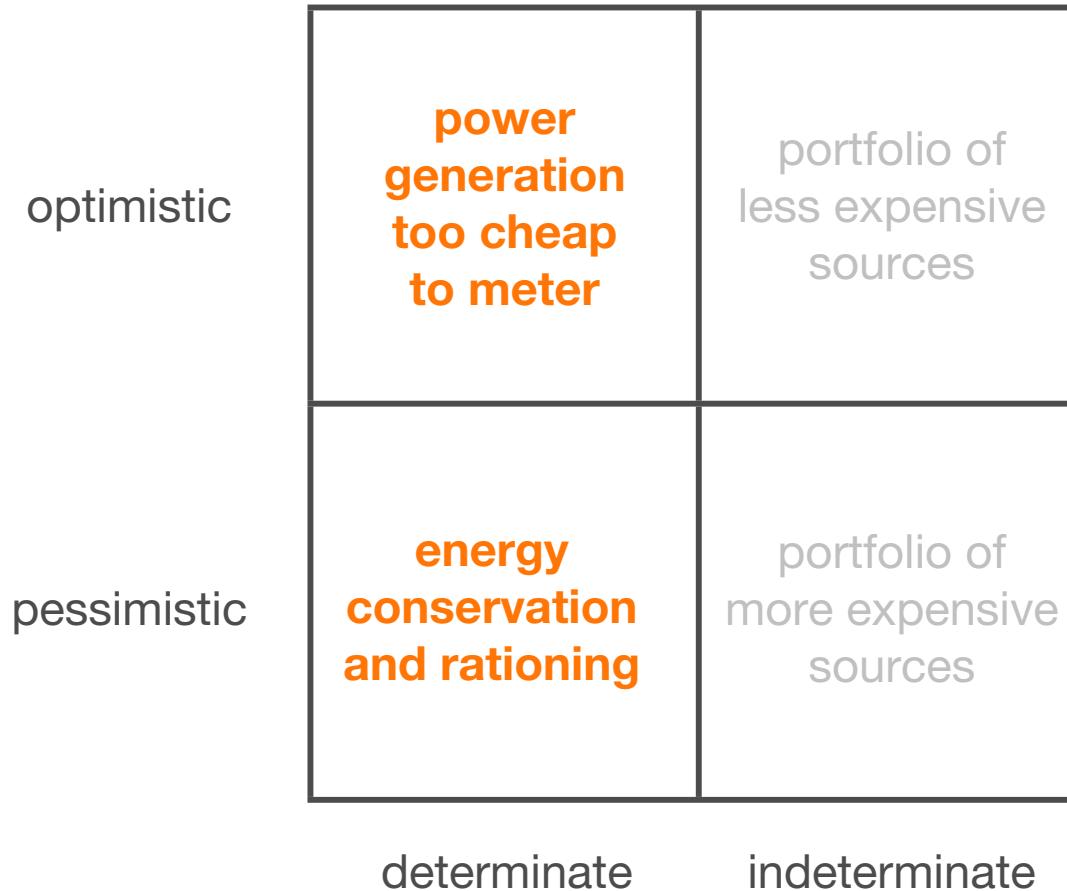
outline

1. thinking about energy
2. a brief history of energy
3. failure of cleantech
4. **energy futures**
5. the government question

the internet as cleantech

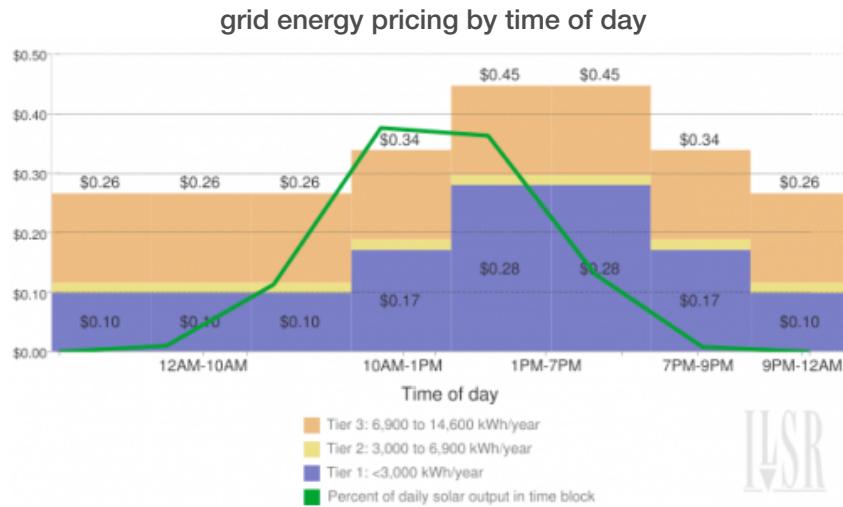


areas to look



opportunities for software

production and the grid



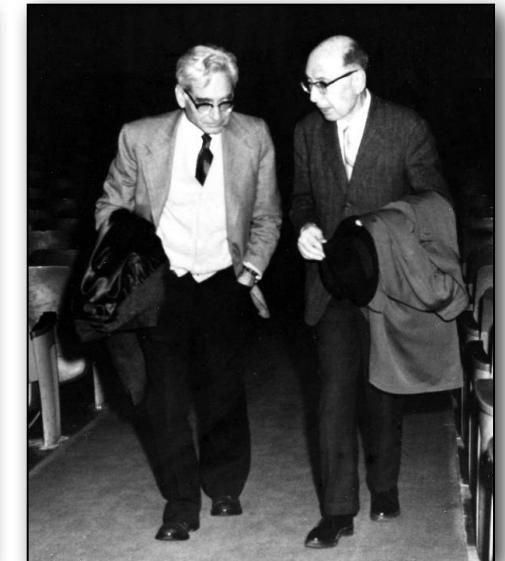
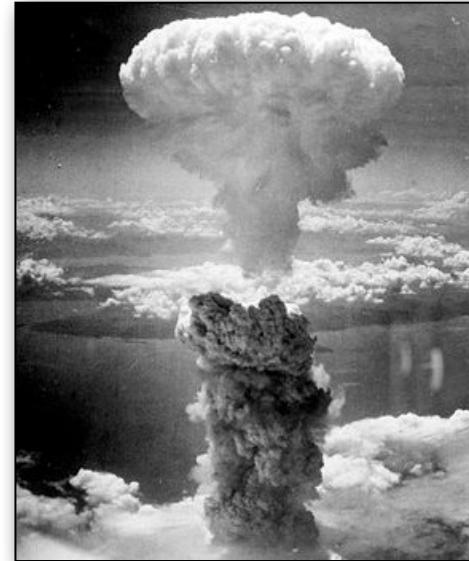
transportation



example - energy from Thorium

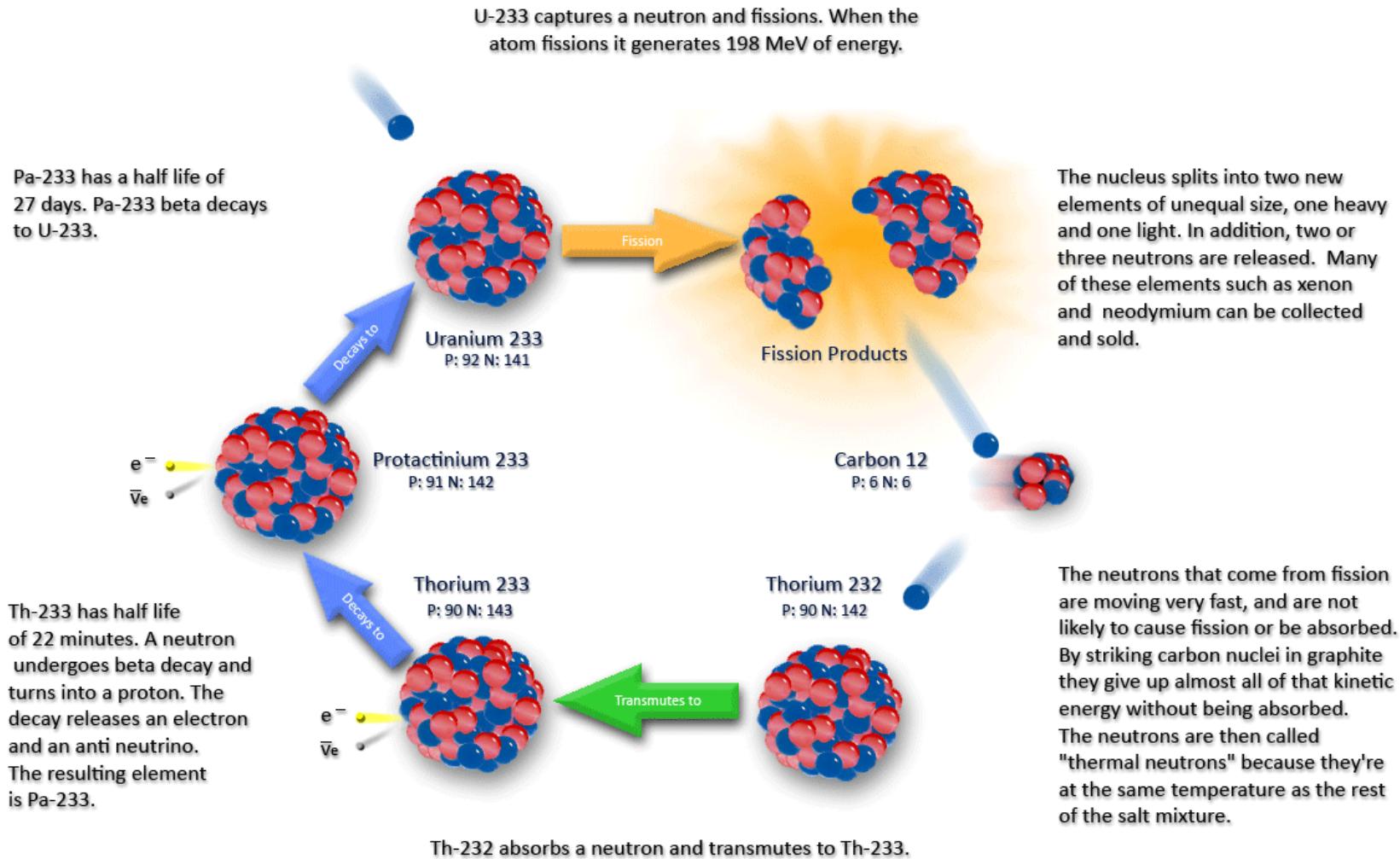
know an important secret

it was proven once before...



but abandoned for political reasons

lets you do more with less



in addition: the production of valuable medical isotopes

both cheaper and better

1 gigawatt per year

uranium

plant: \$1.1 billion

staff: 500 employees

fueling costs: \$30 million a year

thorium

plant: \$250 million

staff: 30 employees

fueling costs: \$1 million year

over 60 years

\$82M cost per gigawatt-year

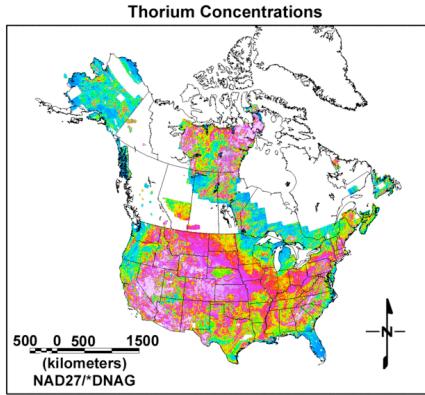
\$8M cost per gigawatt-year

power law?

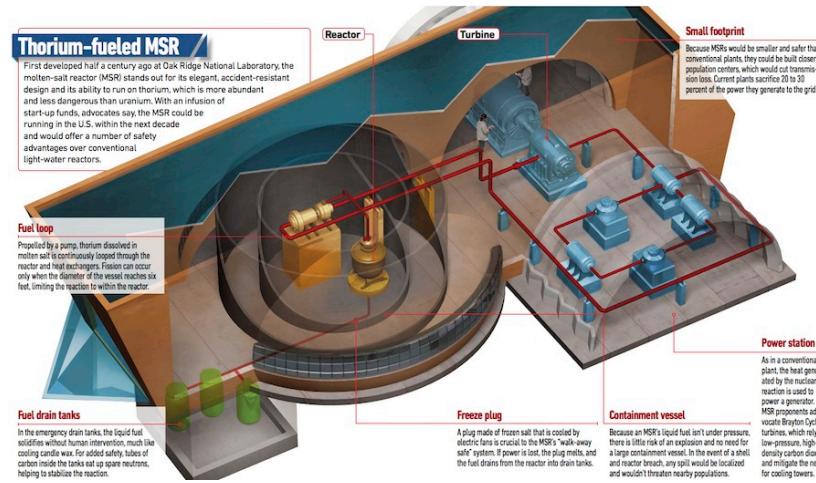


example - energy production

choose the right initial market



have a long term plan



things to get right

markets

- ✓ mimesis and competition
- ✓ secrets
- ✓ incrementalism
- ✓ durability

teams

distribution

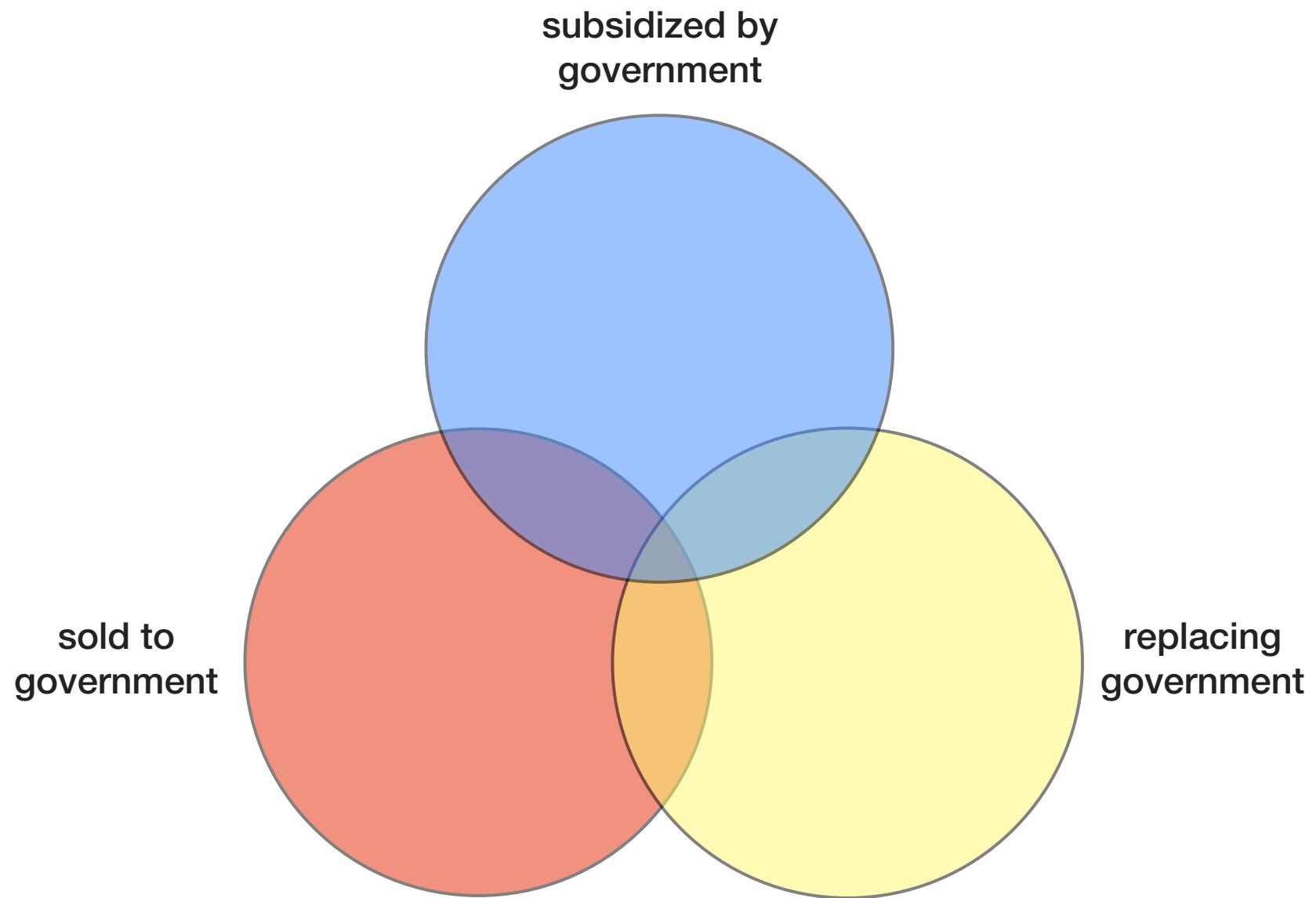
- ✓ timing
- ✓ financing

luck

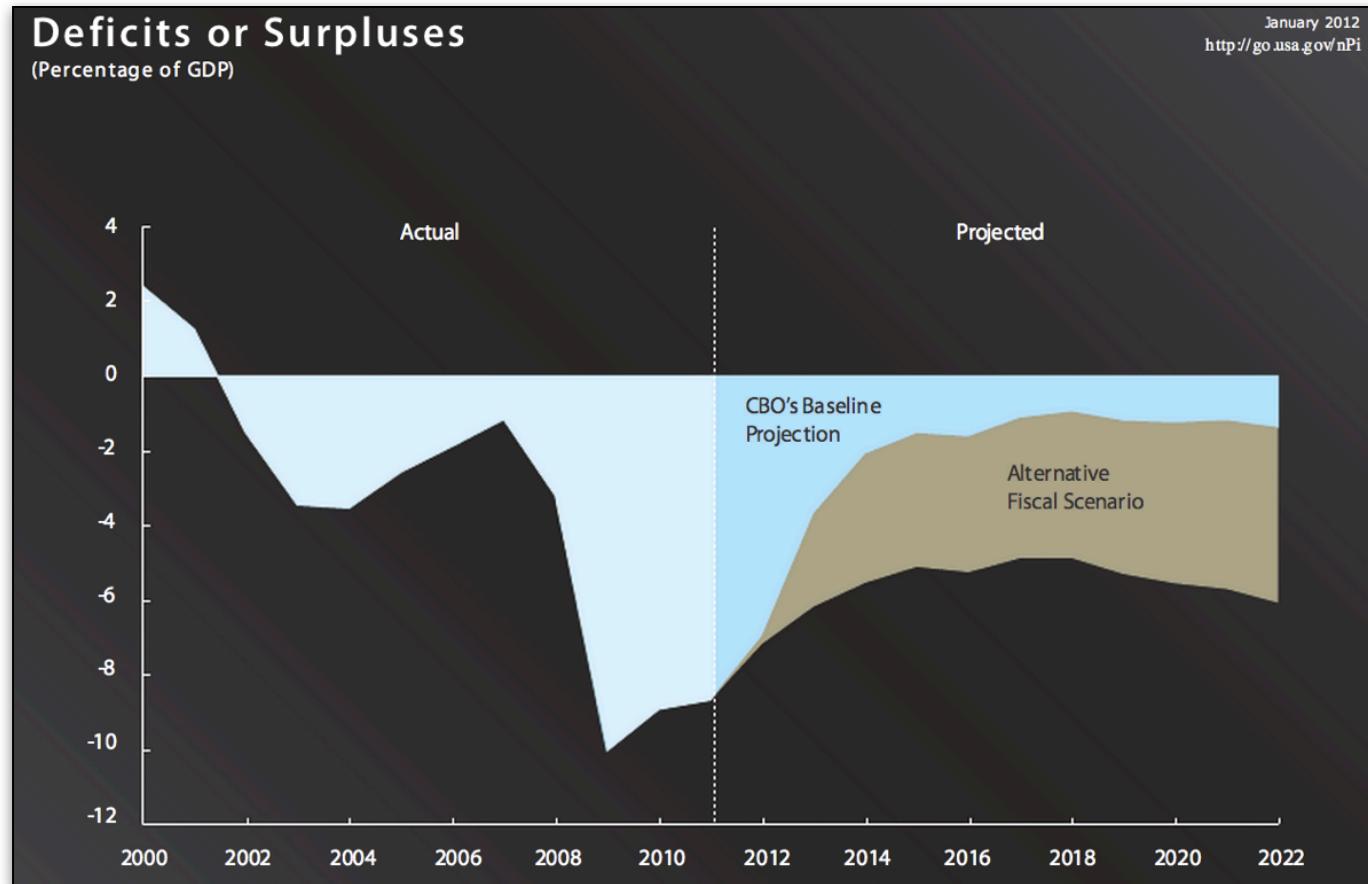
outline

1. thinking about energy
2. a brief history of energy
3. failure of cleantech
4. energy futures
5. the government question

working with the government



a cheaper form of government



areas to be improved

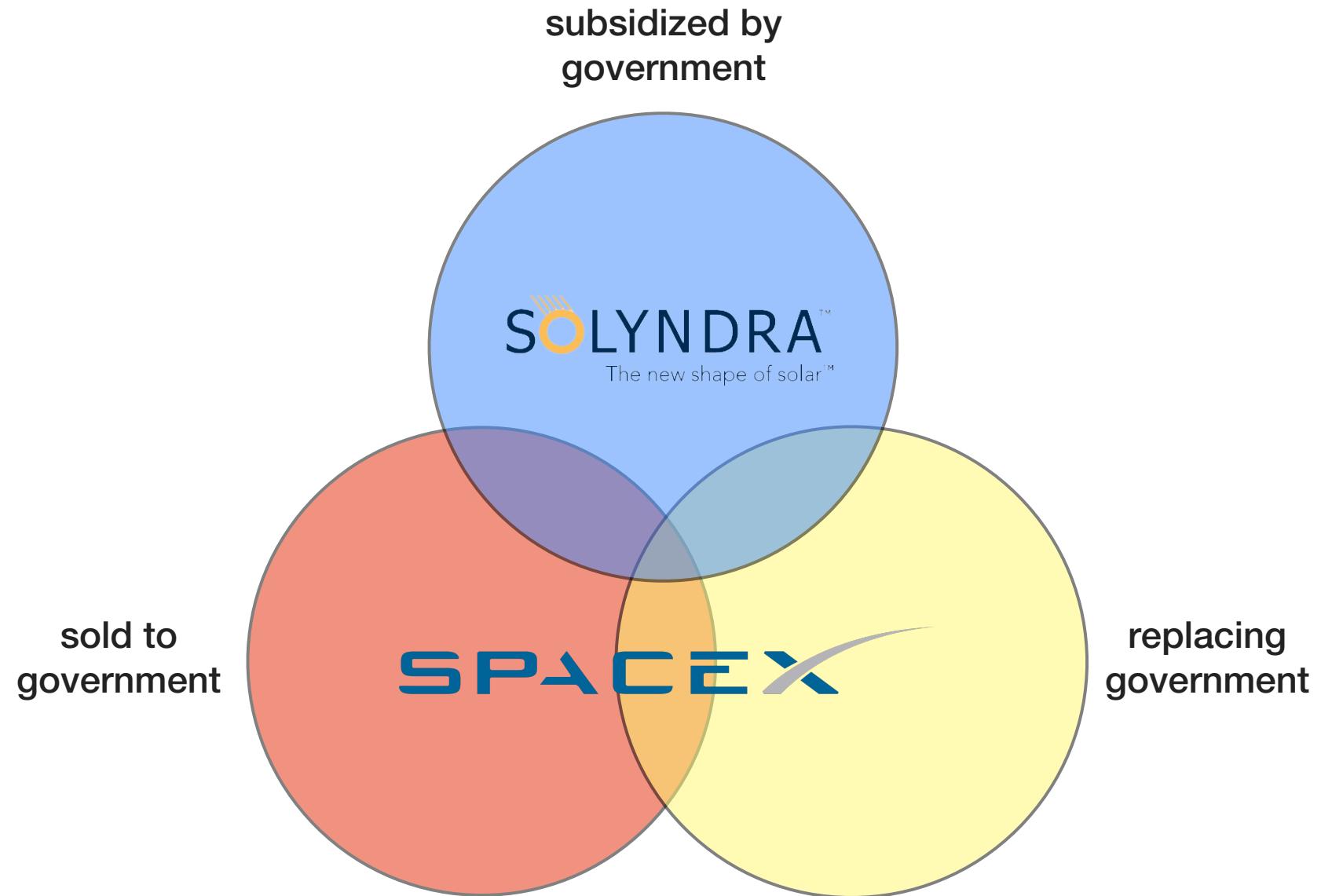
replacing the government

education

healthcare

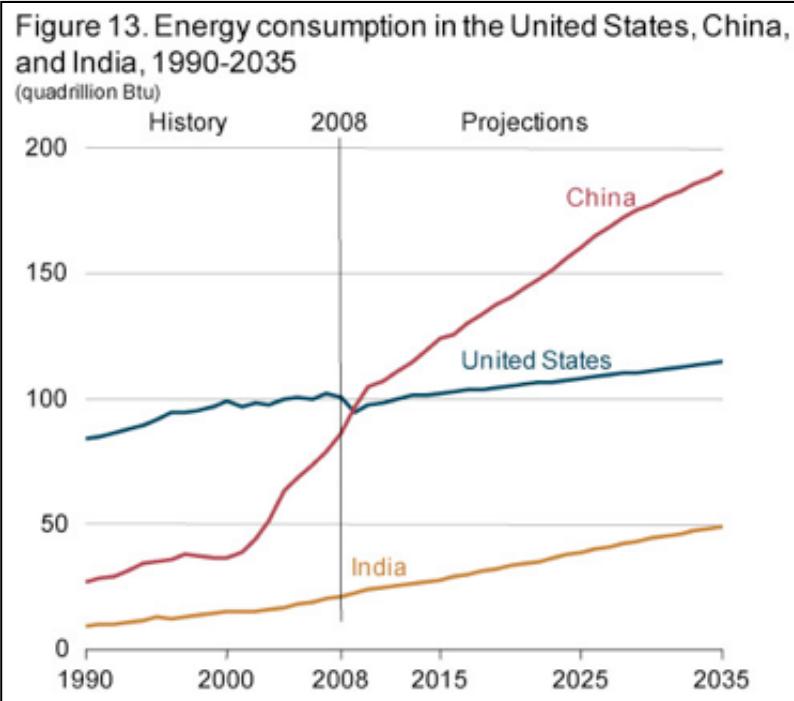
military

a key distinction



globalization

power



transportation

