

What Will Limits to Growth Look Like in Switzerland?

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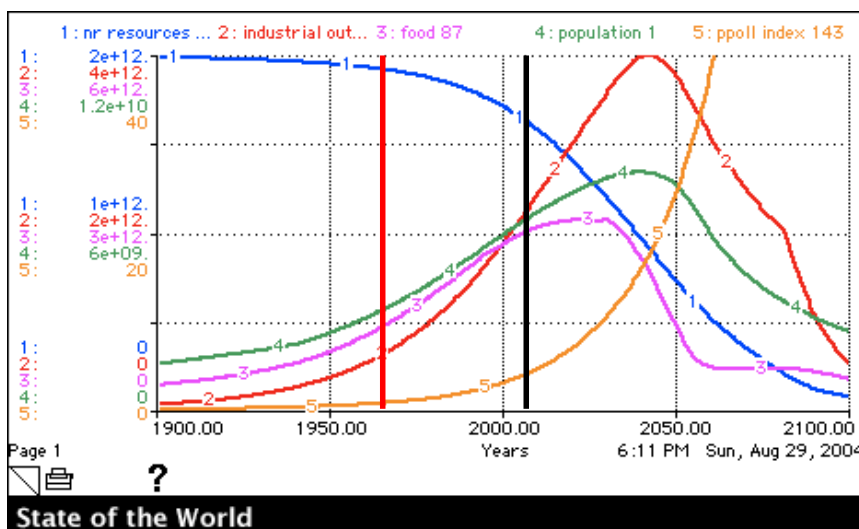
The Sustainability Forum

Zurich

30. Oktober, 2008

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Our reference scenario



Pollution

Population

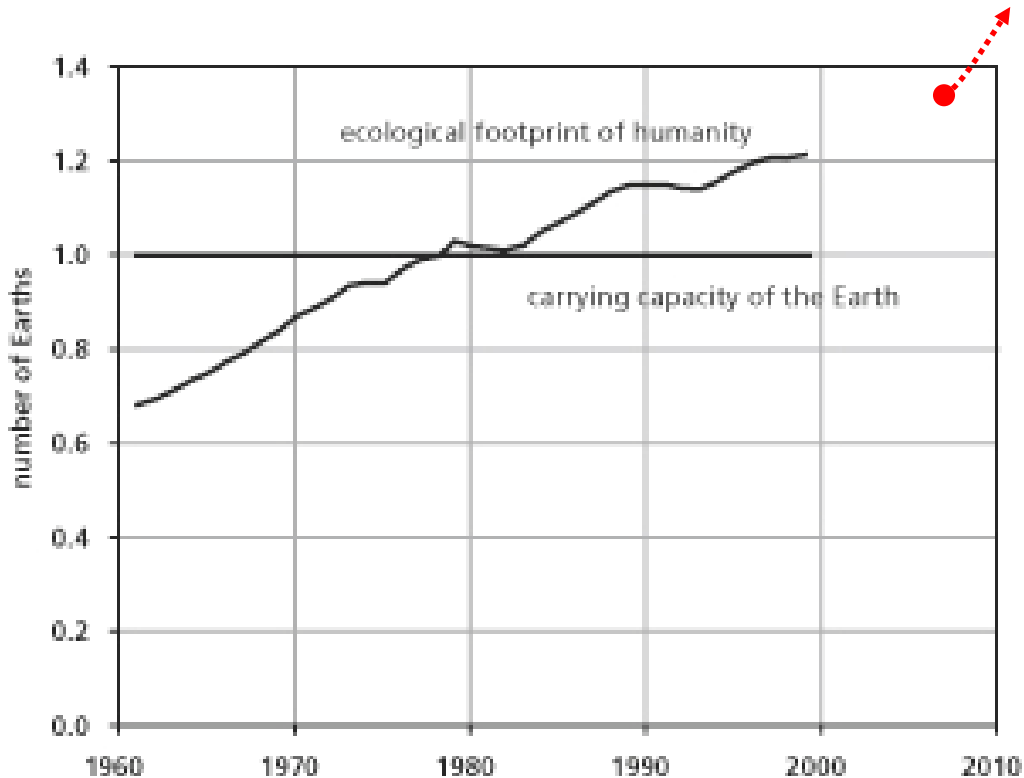
Industrial Output

Food

Resources

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One Indicator of Overshoot



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The major problems come before the end of growth, not after

- Most people believe that the big problems would be during the period of decline. This is wrong.
- In order to stop growth, social, economic, biological, and economic pressures must grow until they equal the forces that produce growth. So the biggest problems will come before the peak.
- Consequently, there will be more change in the next 2-3 decades than there has been in the past 100 years.

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Questions for Switzerland

- What forces will stop global growth in population and industry?
- When will they occur - fast or slow?
- How will they exert their influence on Switzerland?
- What can be done inside your country to minimize their impact?

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Exercise

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The Standard View of Limits to Growth

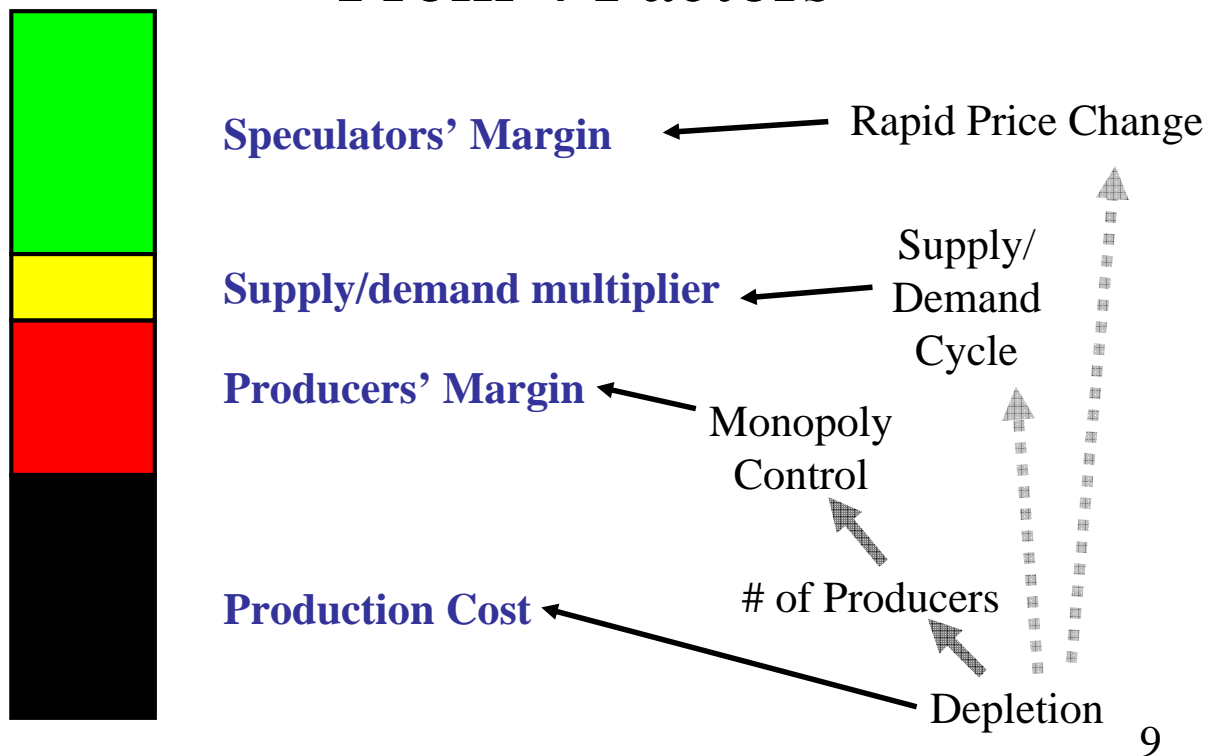
- “In 1972 the Club of Rome predicted that the world would run out of oil by the 1990s.
- Now the 1990s are past and the world has more oil today than it did in 1972.
- Therefore the Club of Rome was wrong.
 - **Advertisements by Mobil Oil Corporation in the *Wall Street Journal* several times from 1990 - 2004**

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Oil Price Results From 4 Factors



We Used the Wrong Title for our Book

- We did not prove that there are limits.
- But for those who believe there are limits, we showed that they will be reached quickly and that the natural tendency of the global system is to overshoot its limits and then go through a period of decline.
- Not *Limits to Growth* but *Dynamics of Growth in a Finite World*

The Three Main Conclusions about Growth Dynamics

- Population and the financial economy naturally grow exponentially, not linearly. So they can reach large numbers very quickly.
- Thus no matter how high the limits, the global system will reach them soon.
- The natural tendency is to overshoot limits and then to fall back to (much lower) levels.

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The present financial crisis illustrates these dynamics

- The growth was explosive; exotic debt instruments grew by more than 1000 in 15 years.
- The dominant view was that the situation was under control, but no one really understood the system.
- When the crisis was obvious, it was too late to avoid serious damage. Most areas expected to escape, but they were affected by the global network of connections.
- Cost of repairs >>>> cost of prevention
- The damage will last many years and the situation will never return to its previous state.

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Other factors related to growth will show the same dynamics

- Global oil production will fall by 50% over the next several decades, and alternatives will not fill the gap.
- Global climate change will produce drastic changes and fluctuations in precipitation, temperature, and ecology by 2050.

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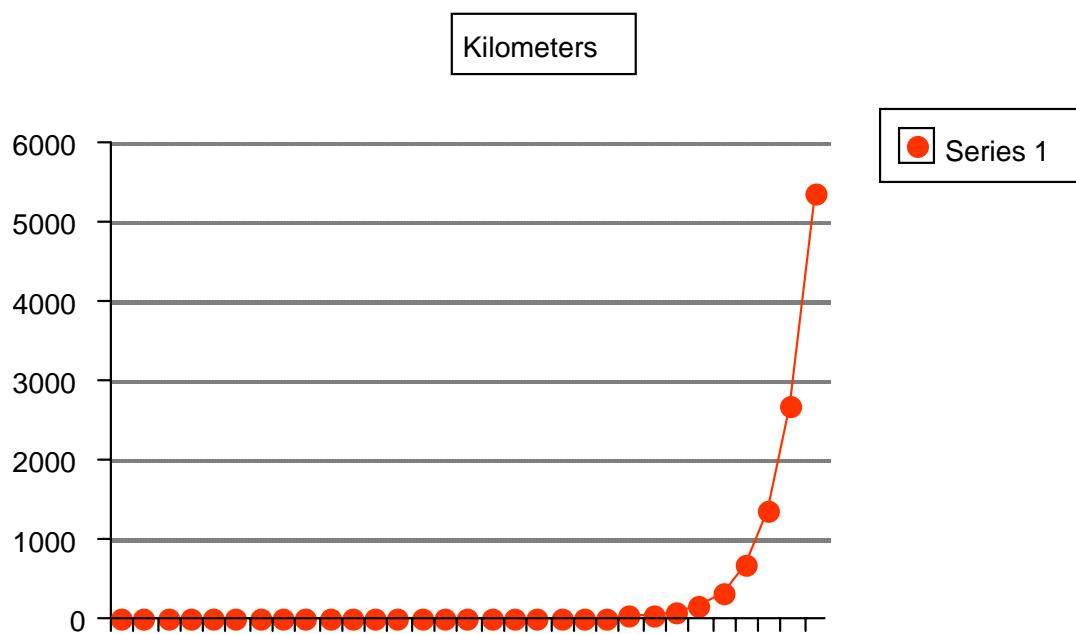
I will describe one limit, for global oil production, in a way that illustrates the approach

- Illustrate the power of exponential growth.
- Describe the interaction of exponential growth with finite energy supplies.
- Define two types of problems and two types of policies.
- Show that price changes will not signal the important problems nor show the best solutions

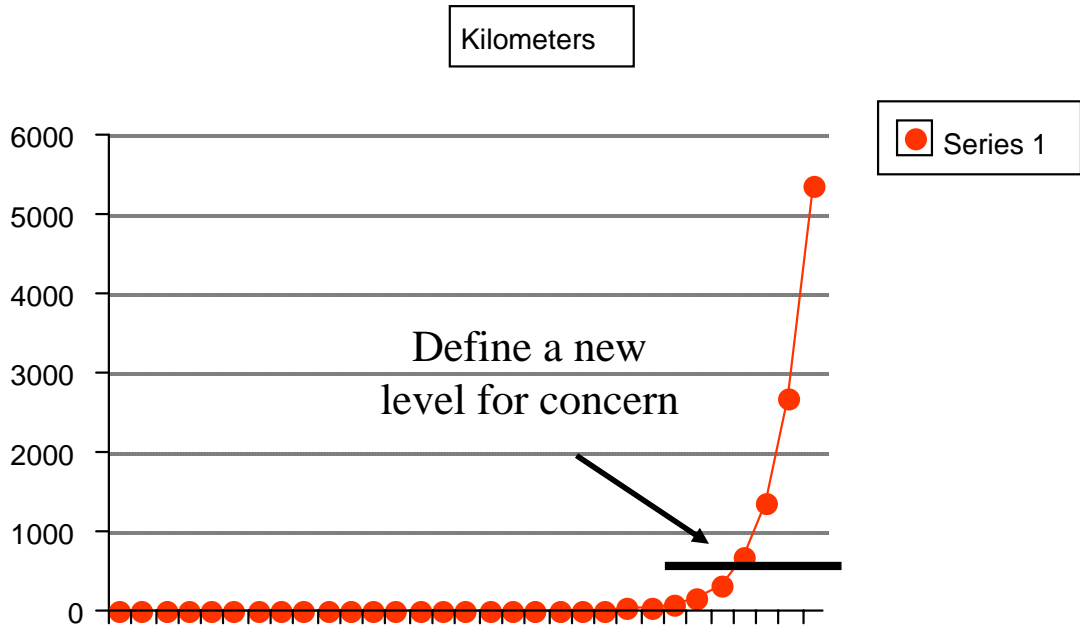
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Exercise

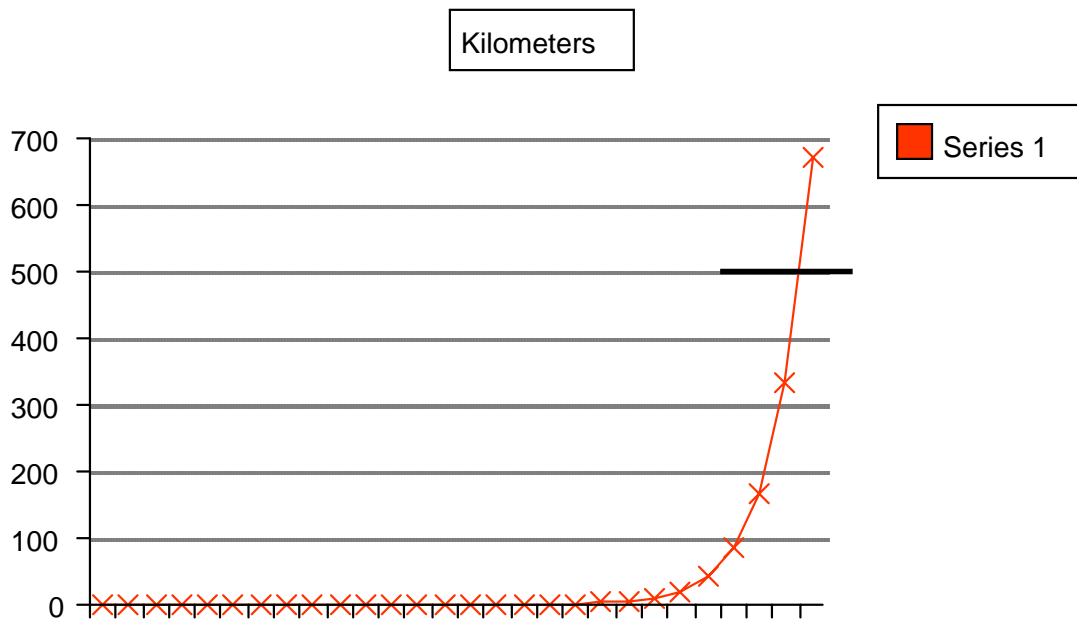
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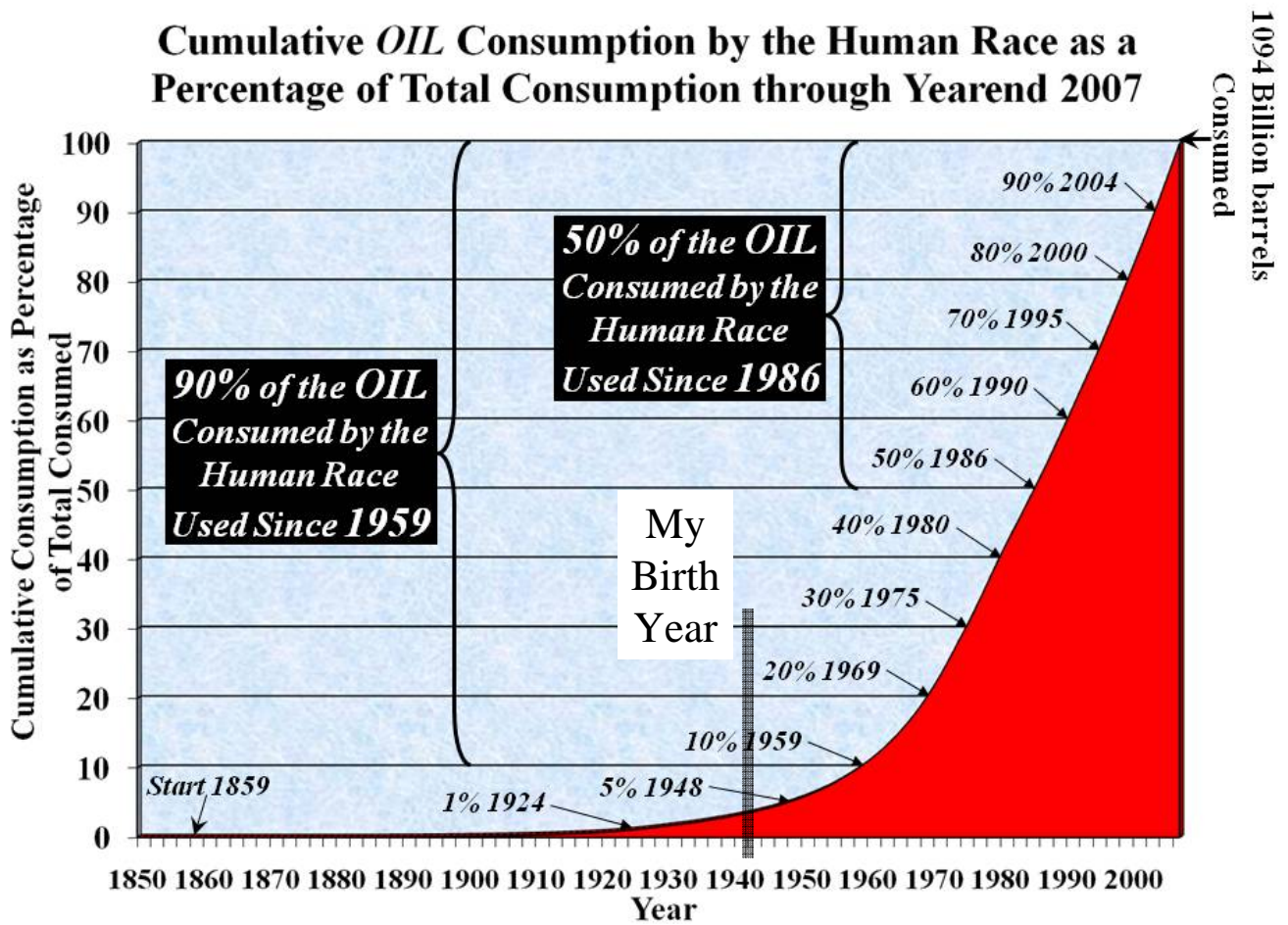


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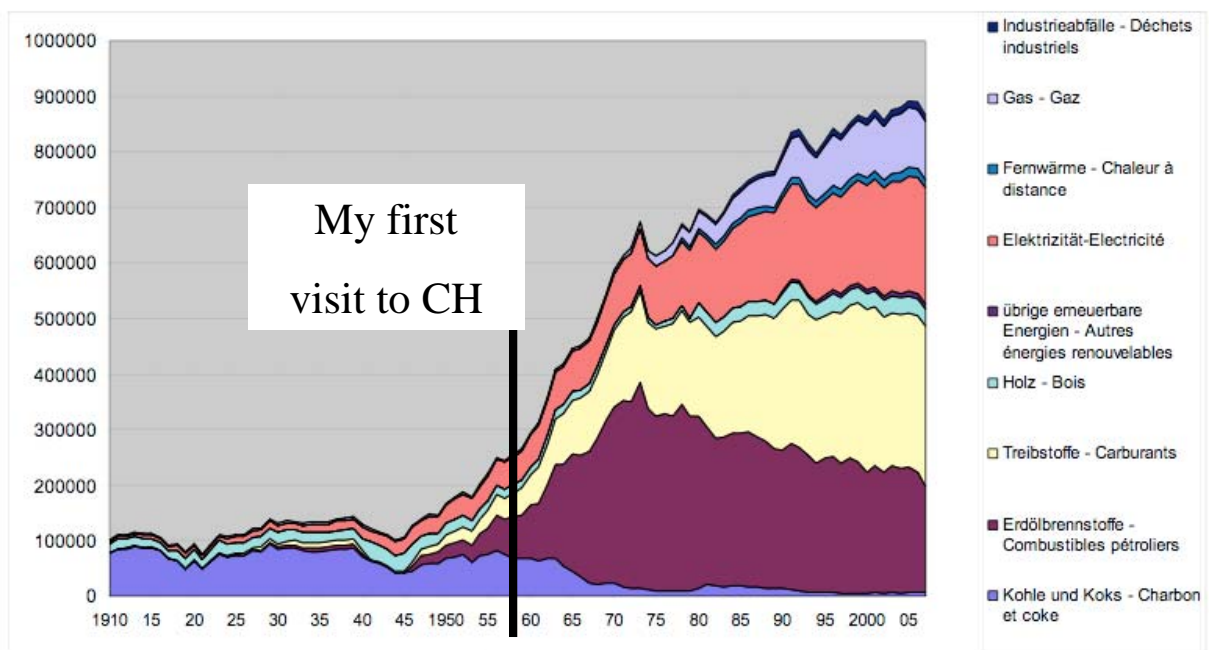


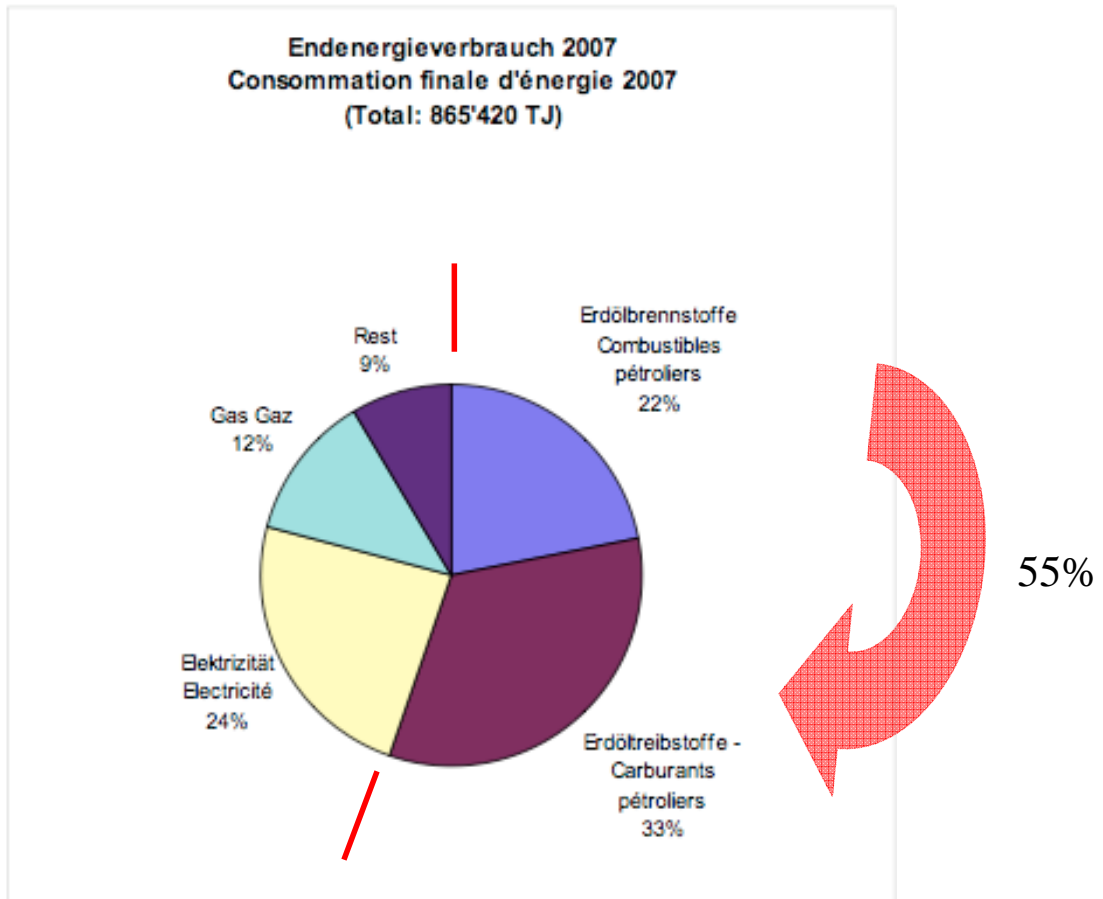
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Cumulative OIL Consumption by the Human Race as a Percentage of Total Consumption through Yearend 2007

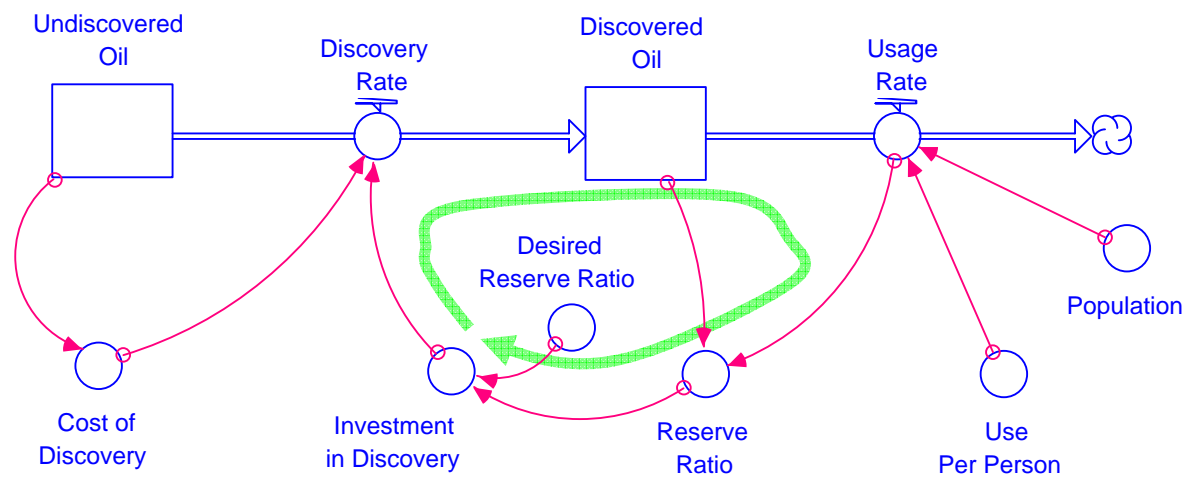


Endenergieverbrauch der Schweiz seit 1910 Consommation finale de l'énergie depuis 1910

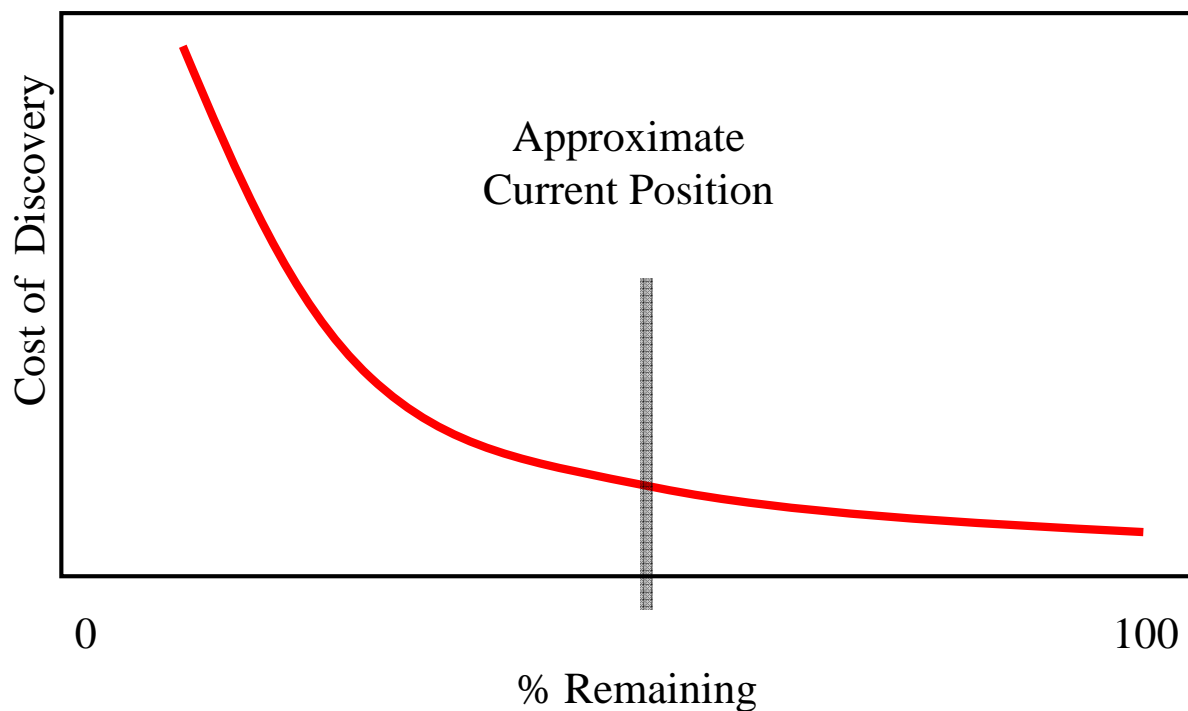




Desired Reserve Ratio Dominates The Oil Discovery System

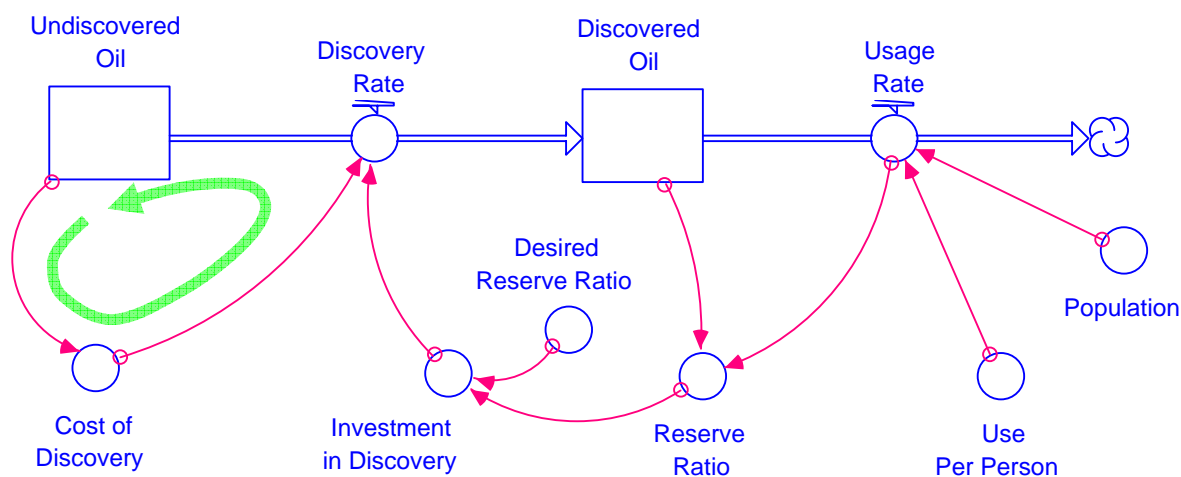


Cost to Discover New Oil



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Oil discovery is now controlled by cost, not by desired reserve ratio



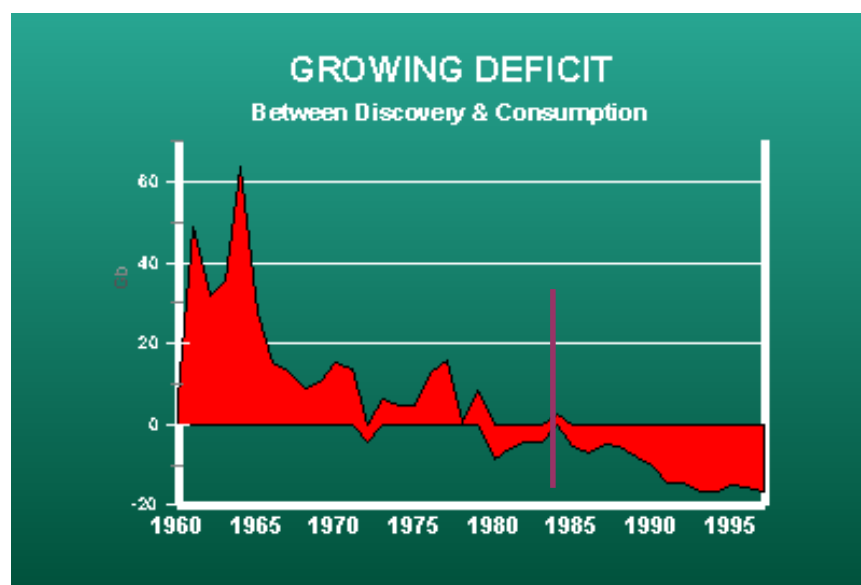
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The Easy Oil is Gone

- Oil discoveries peaked in 1960s; in 2006 discoveries = 9 bb, consumption = 31 bb
- Of the world's 20 largest oil fields, 18 were discovered 1917 - 1968; 2 in the 1970s; 0 since.
- Oil production in 2007 is lower than in 2006.
- World will struggle to meet oil demand.
Without extra investment, the natural rate of decline is 9.1%/year.
– *Financial Times* 29/10/08

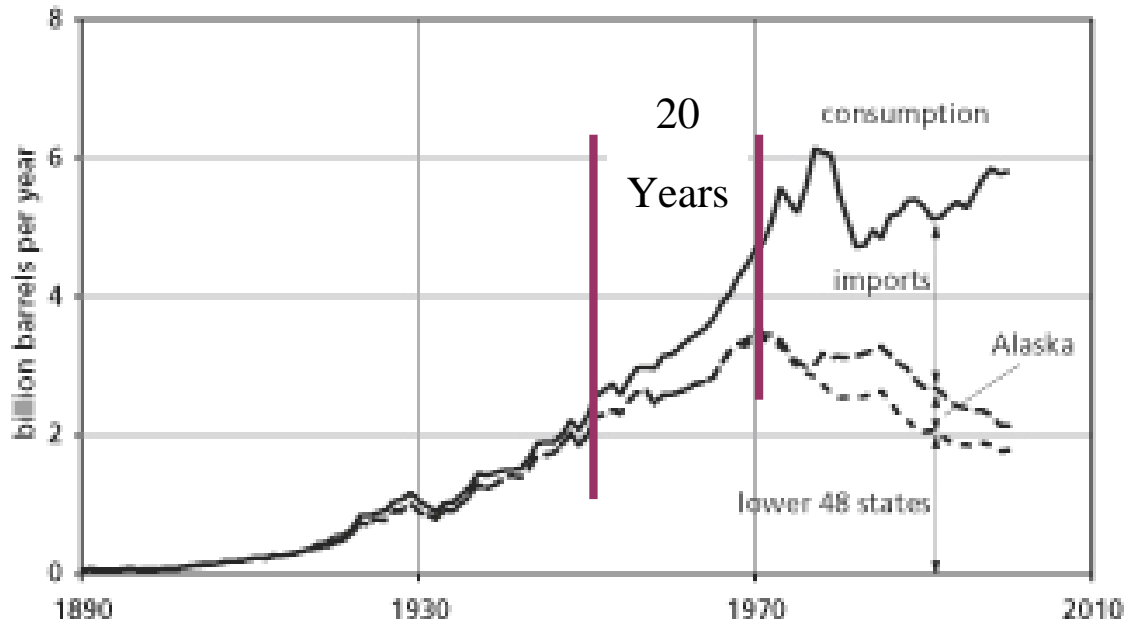
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Gap between Discovery and Use



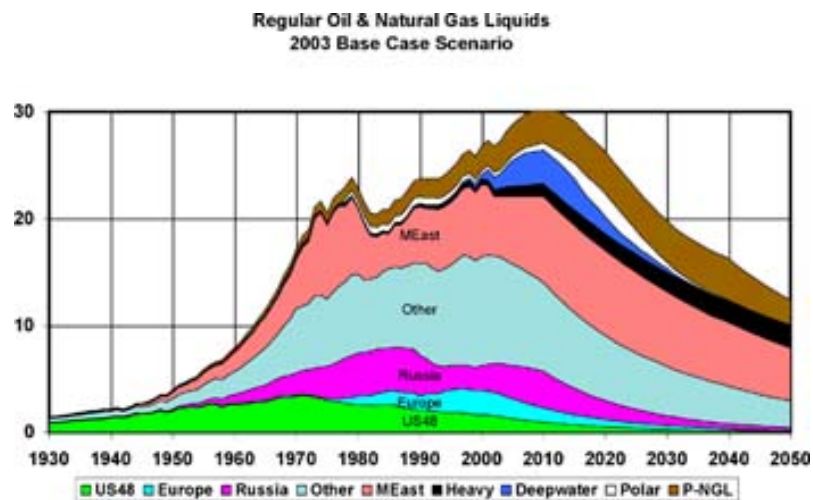
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US Production Peaked in 1971



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Global Oil Production Profile



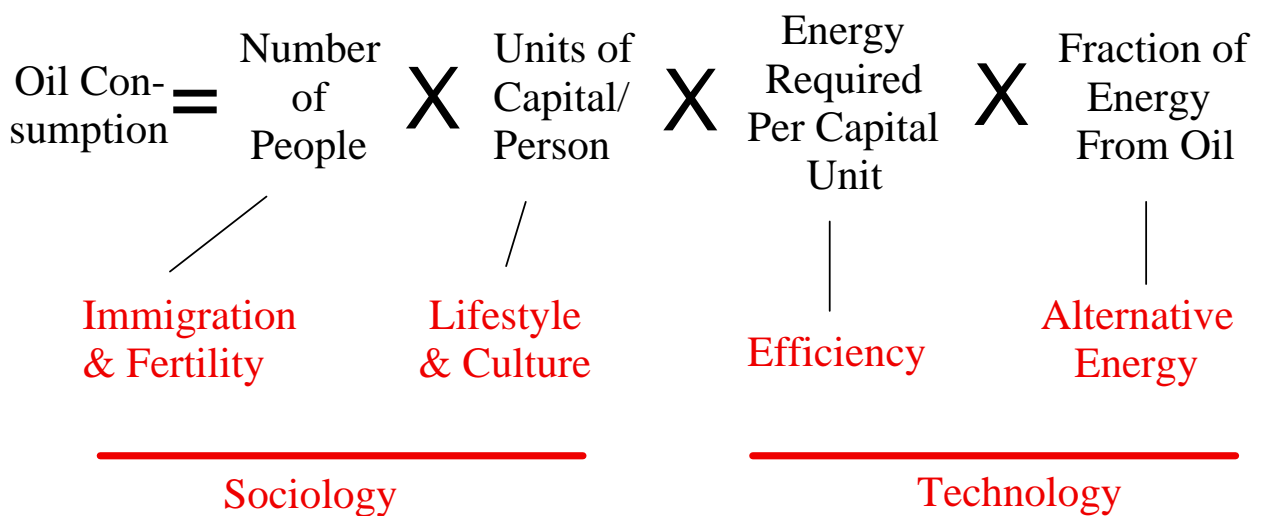
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Reasons for Concern about Oil Use

- Buying energy costs money - it reduces family living standard and increases national debt.
- Burning fuels causes air pollution, such as particulates, that damage human health.
- Burning fuels causes CO2 buildup, hence climate change.
- Dependency on imports increases political problems.
- Supply disruptions cause personal difficulties, damage the economy, and reduce critical government services when supplies become unaffordable or completely unavailable.
- The threat of oil depletion will promote bad policy, for example in the nuclear sector.

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Four Factors Determine the Amount of Oil Consumption



Categorizing Problems & Solutions

- Problems
 - Global vs Universal
- Policies
 - Mitigation vs Prevention
 - Easy vs Difficult

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- **Global Problems** affect everyone and they can only be solved by international effort: climate change, ocean fish depletion, nuclear proliferation.
- **Universal Problems** affect everyone and they can be solved locally by local action: soil erosion, water pollution, oil depletion.

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- **Mitigation Strategies** are required when it is too late to avoid a problem; for example, climate change and oil depletion.
- **Prevention Strategies** are required when it is still possible to avoid a potential future problems; for example epidemics, nuclear proliferation

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Comparison of Costs & Benefits

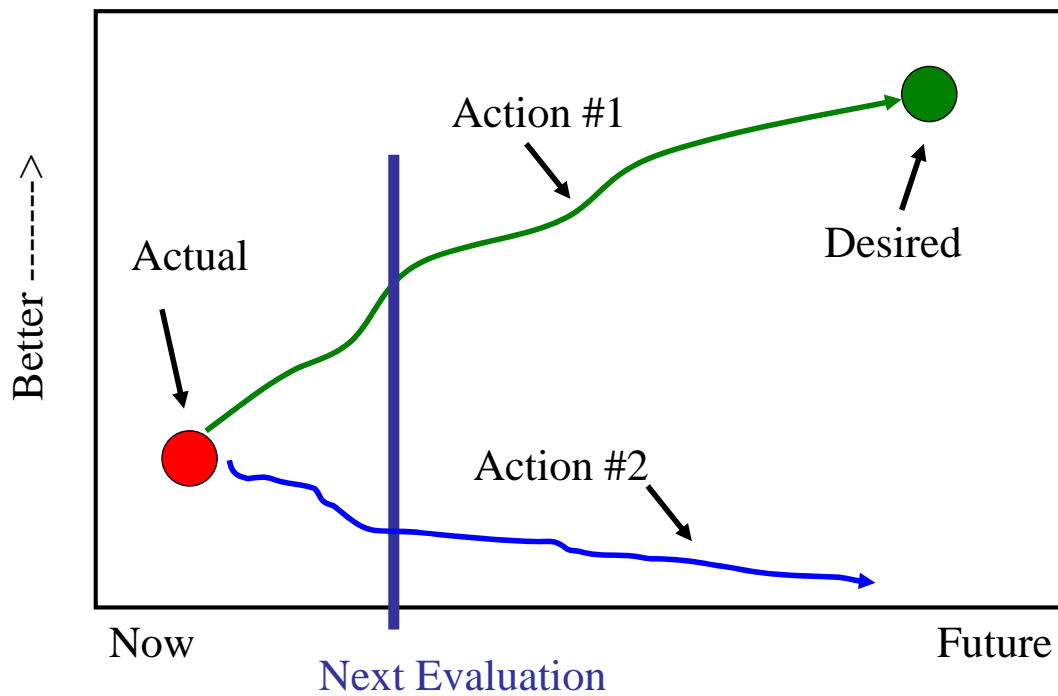
Costs of action are here and now

Benefits are:

	Mitigation	Prevention
Global Problems	here & later	there & later
Universal Problems	here & soon	here & later

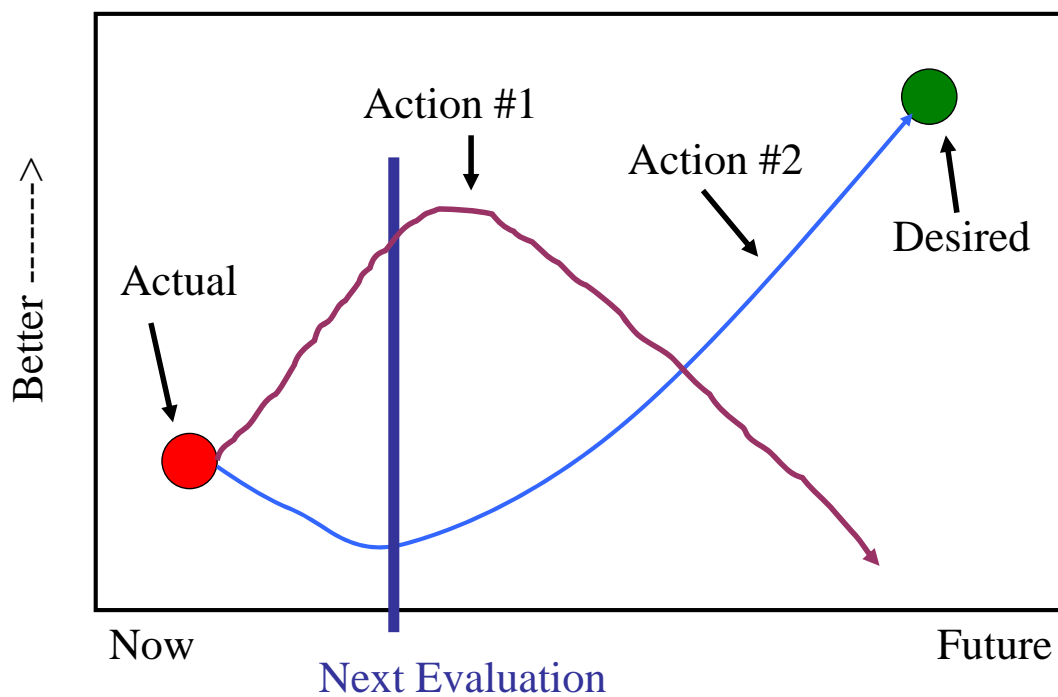
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Easy Problems



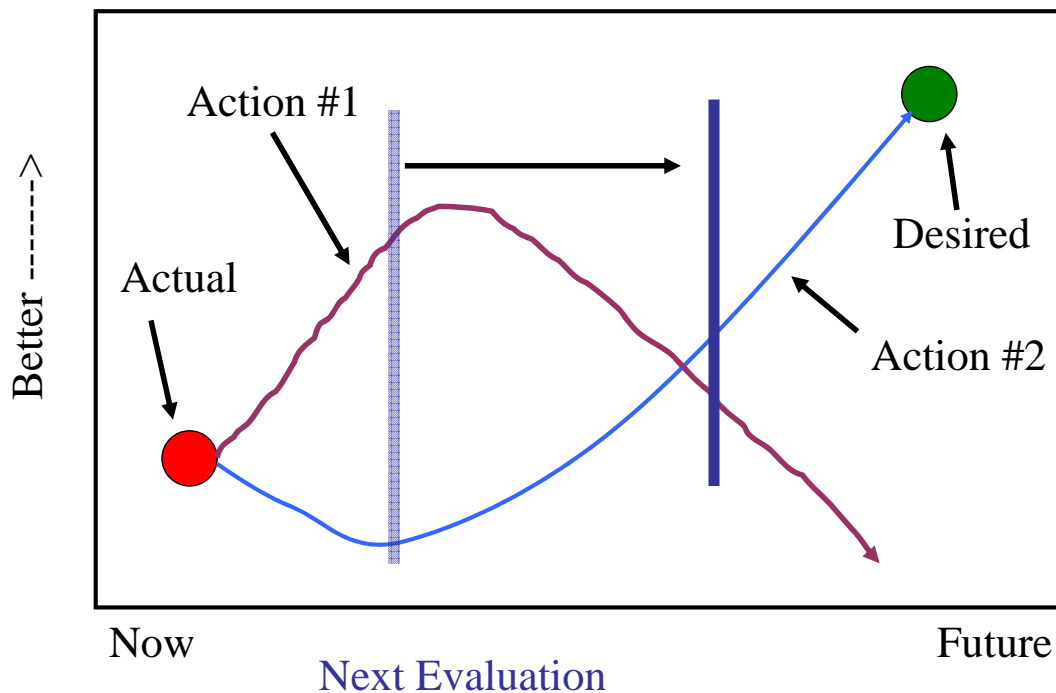
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Difficult Problems



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Difficult Problems Become Easy with Greater Time Horizon

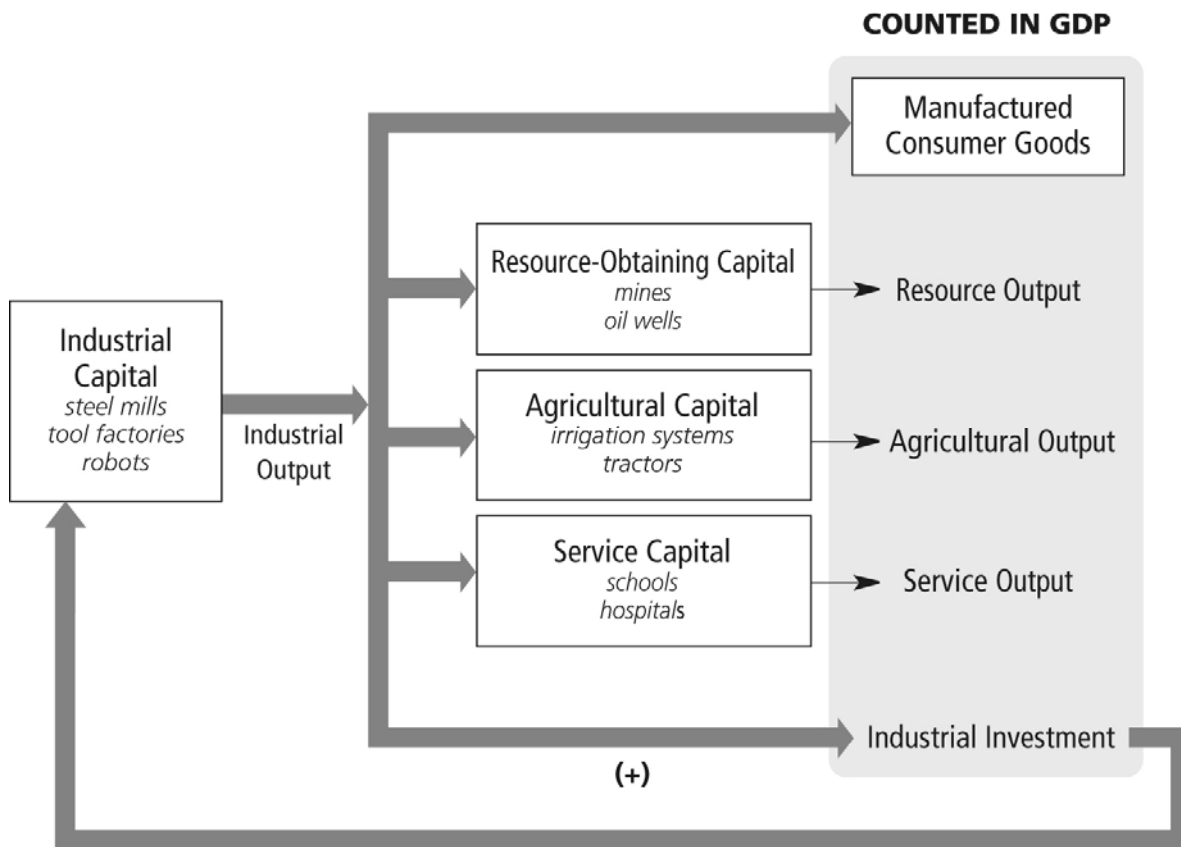


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Two sources of difficult problems

- The increased capital requirements of the energy sector will reduce potential for growth in other sectors.
- The decline of free energy will force drastic changes in technology and lifestyle.

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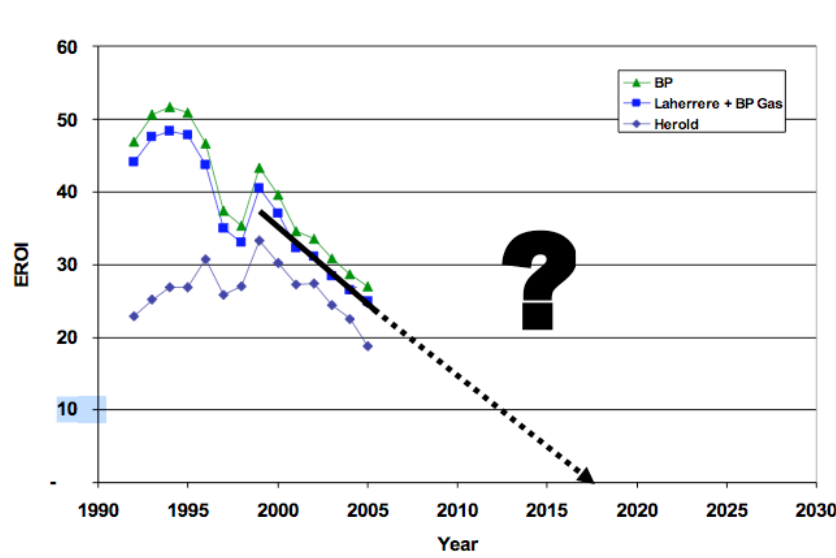
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Some Net Energy Yields

- US Oil 1930 - 100; 1970 - 30; 2005 - 15
- Imported Oil - 30
- Coal - 10 - 80
- Nuclear - 10
- Firewood - 25
- Photovoltaics - 15-45
- Oil Sands - 2-3

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Energy Return on Investment



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Likely trends affecting Switzerland

- Greatly increased pressures for in-migration.
- Rapid changes in the relative value of currencies.
- Breakup of the euro zone.
- Growing protectionism, therefore reduced trade.
- Declining discretionary income -> lower exports of luxury goods.
- Shift to sale of oil in multiple currencies
- Inflation in the cost of imported materials - mainly from
- Growing violence from non-state actors.

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Principles for action - 1

- Develop the government, corporate, and cultural capacity for sustained long-term action.
- Expect the present market system to magnify problems, not avoid them.
- Remember there are enormous delays between action and response; so take action “before it is obviously needed.”
- Preventing damage is cheaper than repairing it.
- Social and cultural policies will give better results than economic and technical policies. Focus on getting enough rather than on getting more.

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Principles for action - 2

- Do not use economic discounting methods to find solutions for problems that produce irreversible results
- Expect problems to appear suddenly.
- Realize that no one fully understands these systems.
- Going back to the past conditions will not be an option.
- Government will be overloaded and will make mistakes.
- Prepare for the worst and hope for the best.

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Exercise