

PEAKING OF WORLD OIL PRODUCTION

**What It Is?
When It Might Occur?
How to Mitigate?
Impacts?**

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The Problem:

At some point, world conventional oil production will no longer meet demand -- Defined as “oil peaking.”

- **WHY?** Finite resource / Rapid depletion.
- **WHEN?** Uncertain - Within 10 years? Later?
- **WHY CAN'T THE PROBLEM BE FIXED QUICKLY?**

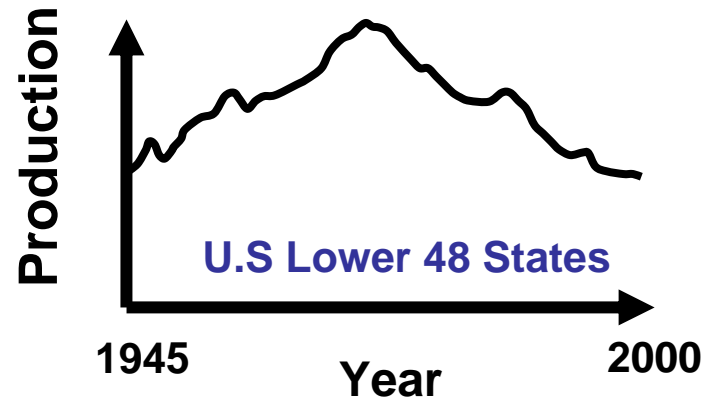
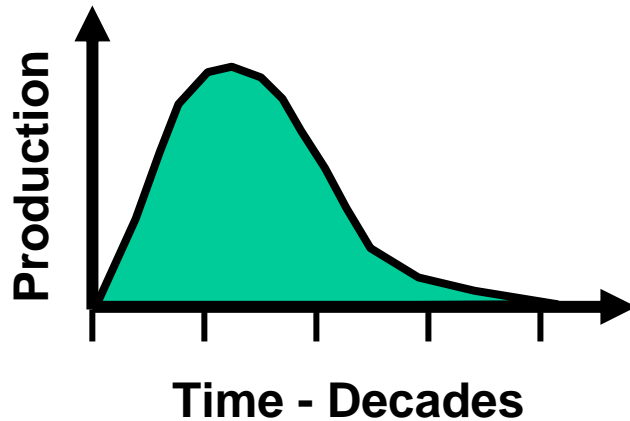


The scale of change is

ENORMOUS

- World oil consumption is over 3 million barrels per hour.
- It would take about 30 seconds to fill this room with oil.

Why will conventional oil production peak?



**Oil fields
peak**

**Regions
(Many fields)
peak**

**The world
(All regions)
will peak.**

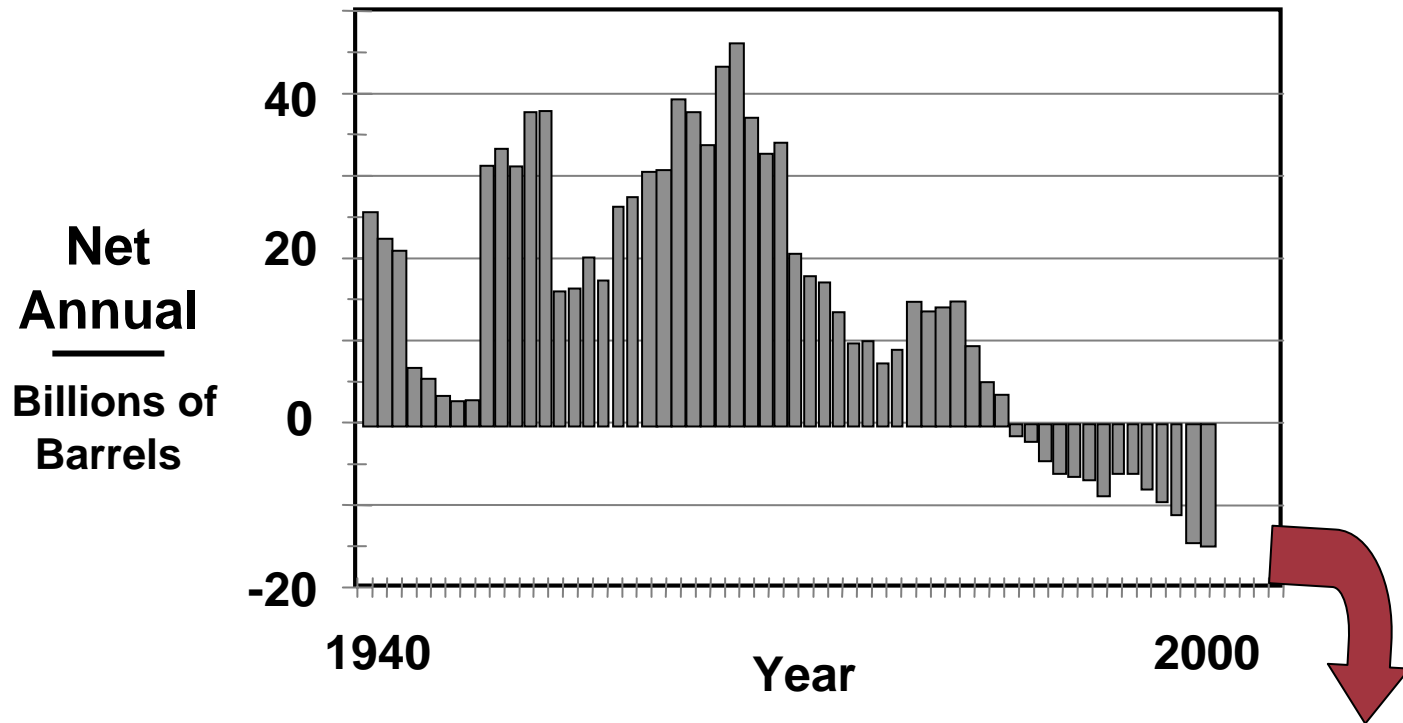
Why worry now?

- World oil demand is huge & growing.
- World consumption is vastly outstripping discoveries.
- Oil production is in decline in 33 of the 48 largest oil producing countries.

**Many experts are deeply concerned.
Economic consequences could be dire.**

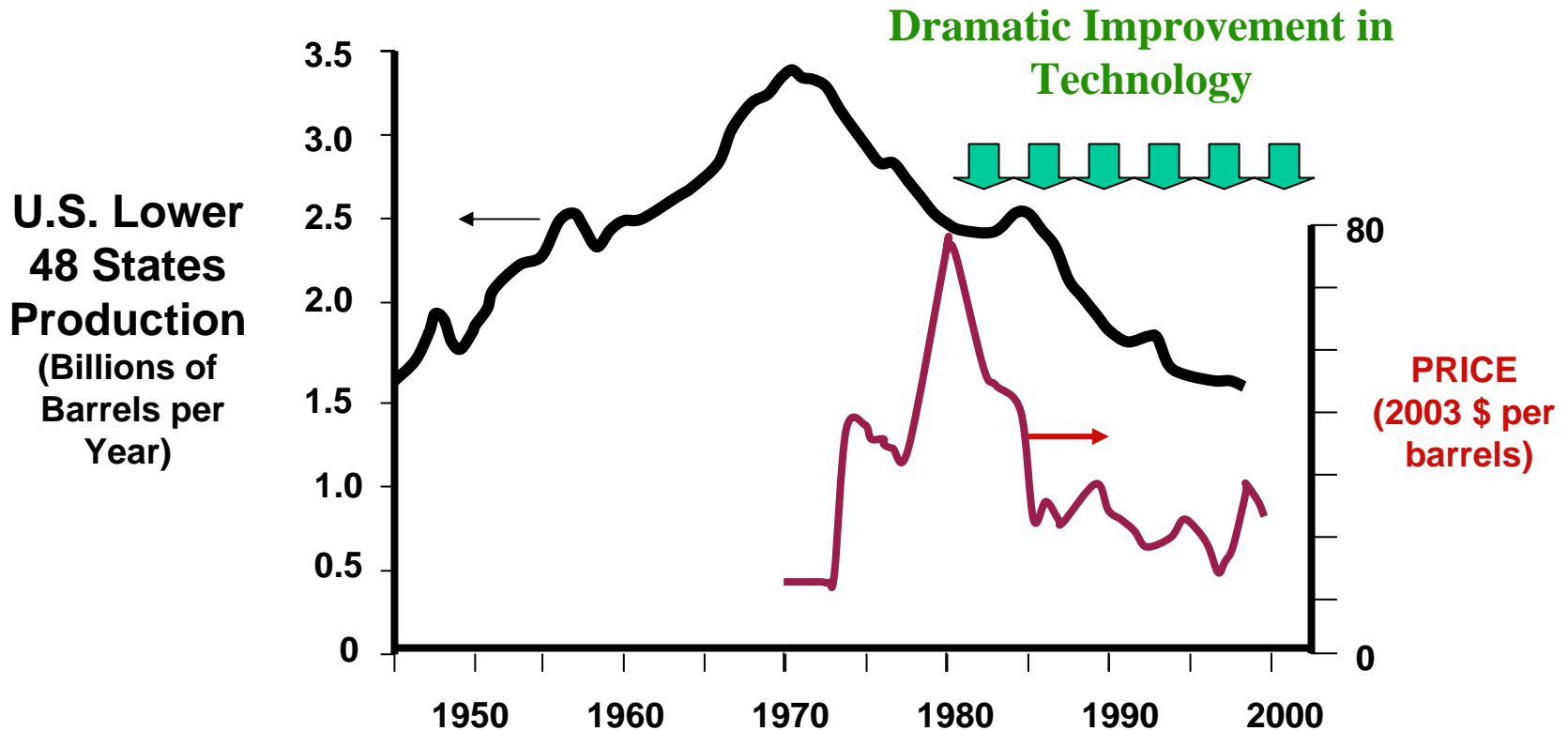
**Peaking is maximum production,
then decline.**

We're finding much less than we're consuming.



The world's first forced energy transition

Can't High Oil Prices & Technology Save Us?

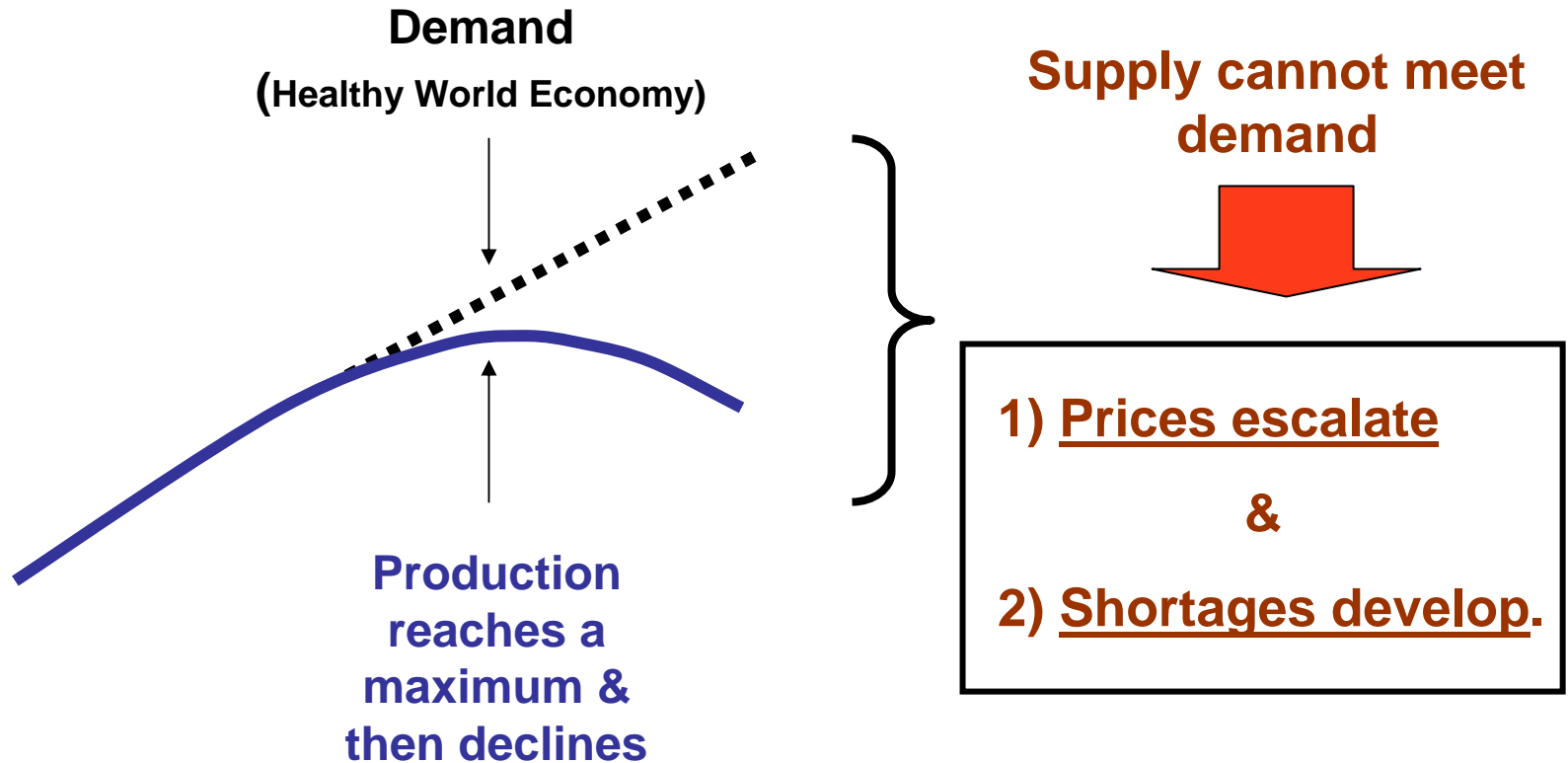


Prices & technology did not reverse the decline!

When will world conventional oil production peak?

<u>Forecast</u>	<u>Source</u>	
2006-2007	Bakhitari (Iran)	}
2007-2009	Simmons (U.S.)	
After 2007	Skrebowski (U.K.)	
2008	Campbell (Ireland)	
Before 2009	Deffeyes (U.S.)	
Before 2010	Goodstein (U.S.)	
		5 years
After 2010	World Energy Council	}
2012	Weng (China)	
2016	Doug-Westwood (U.K.)	
		5-10 years
After 2020	CERA (U.S.)	}
2031 or later	EIA (U.S.)	
		> 15 years

What's likely to happen at peaking?



Oil production in decline in 33 of the 48 largest oil producing countries

What was peaking like in the “clean” cases?

1. Sudden onset
2. Sharp declines

Will world peaking be like this?

Three Mitigation Scenarios Analyzed

- Scenario I - No action until peaking occurs
- Scenario II - Mitigation started 10 years before peaking
- Scenario III - Mitigation started 20 years before peaking

Assumptions:

- » Immediate start
- » Crash program implementation

Optimistic limiting cases

Mitigation Options We Considered

- Vehicle fuel Efficiency
- Heavy oil / oil sands
- Coal Liquefaction
- Gas-To-Liquids (GTL)
- Enhanced Oil Recovery (EOR)

Why these? There're ready for

Implementation

Options Not Included in Our Analysis

<u>Option</u>	<u>Reasoning</u>
– Nuclear	} <u>Electric / NOT LIQUID FUELS</u>
– Wind	
– Solar	
– Hydrogen.....	Neither ready nor economic
– Biomass.....	Not economic
– Shale Oil.....	Not commercial

U.S. Oil Consumption

- **~20 MM bpd (2003)**
- **~25% of world oil demand**
- **~ 66% transportation**

U.S. Transportation - 2003

	Autos	Light Trucks	Heavy Trucks	Airplanes
Share of transport fuel consumption	39%	28%	24%	9%
Fleet size - Millions	130	80	7	0.0085
New - Millions/Year	8.5	8.5	0.5	Small
Median life - Years	17	16	28	22



Biggest, fastest savings

Transportation Equipment Changes

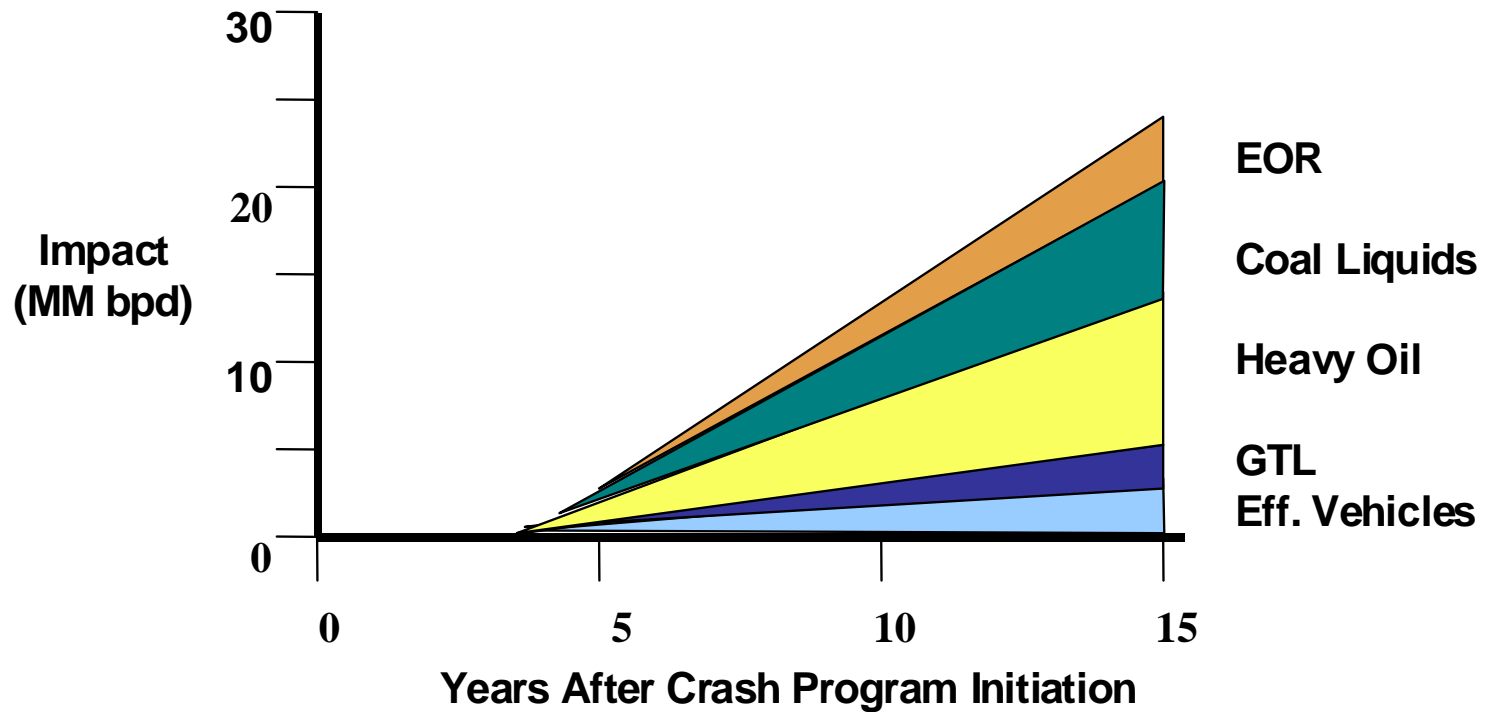
- Large efficiency improvements possible in some fleets, smaller in others.
- Some fuel switching possible in some equipment in the short term, more longer term.

Change is slow & expensive.

Fuel must be provided for existing fleets.

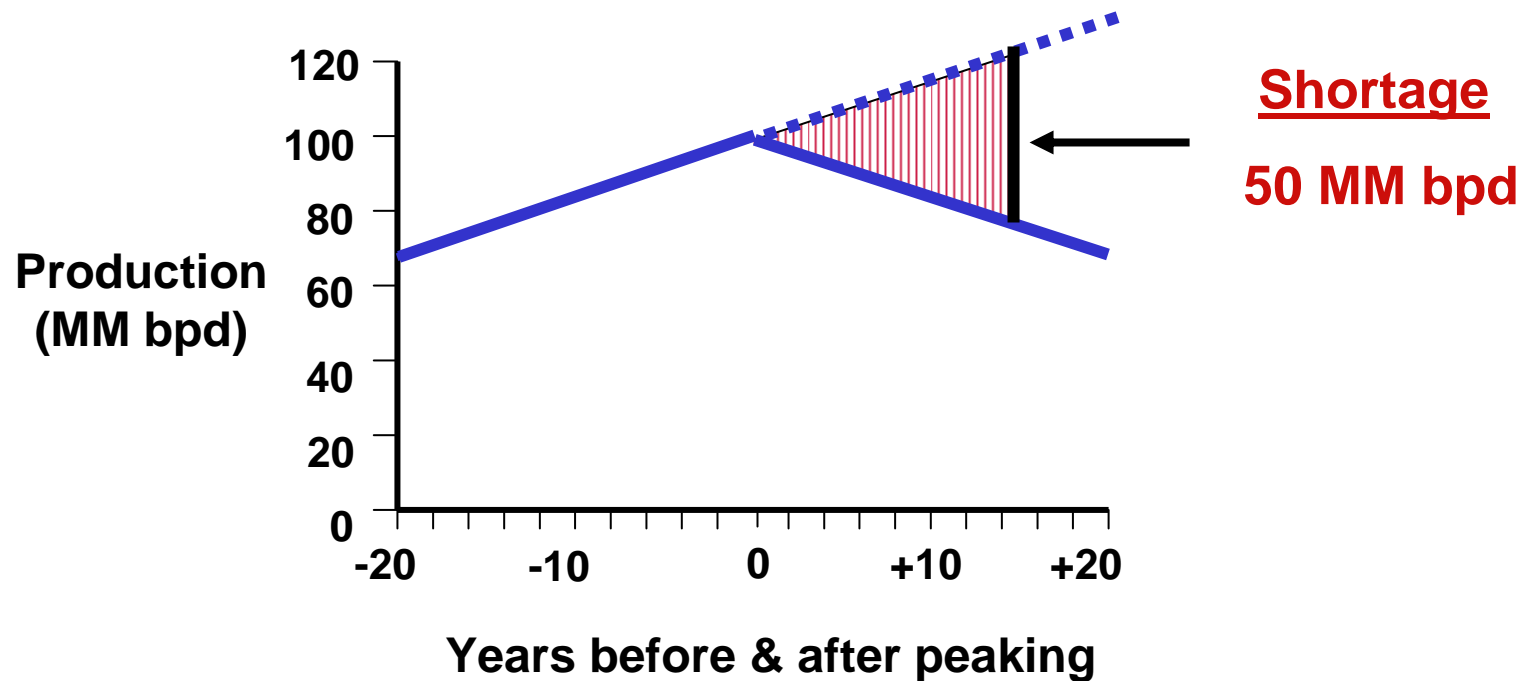
Optimistic Mitigation Contributions

Crash Program / Delayed Wedge Approximations



Delay, then roughly 25 MM bpd at year 15

But the world shortage could be 50 MM bpd, 15 years after world oil peaking



World modeled after the U.S. Lower 48 production pattern, 100 MM bpd at peak, & continuing demand associated with a growing world economy.

Scenarios Analysis Conclusions

Basis: Immediate crash program implementation

Scenario	Result
Wait for peaking	Oil shortages largest, longest lasting
Start 10 years early	Delays peaking; still shortages
Start 20 years early	Avoids the problem; smooth transition

No quick fix!

Forecasts of World Conventional Oil Production Peaking

	<u>Forecast</u>	<u>Source</u>
Now →	2006-2007	Bakhitari (Iran)
	2007-2009	Simmons (U.S.)
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	2008	Campbell (Ireland)
	Before 2009	Deffeyes (U.S.)
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	After 2010	World Energy Council
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Now + 10 years →	2016	Doug.-Westwood
Now + 20 years →	After 2020	CERA (U.S.)
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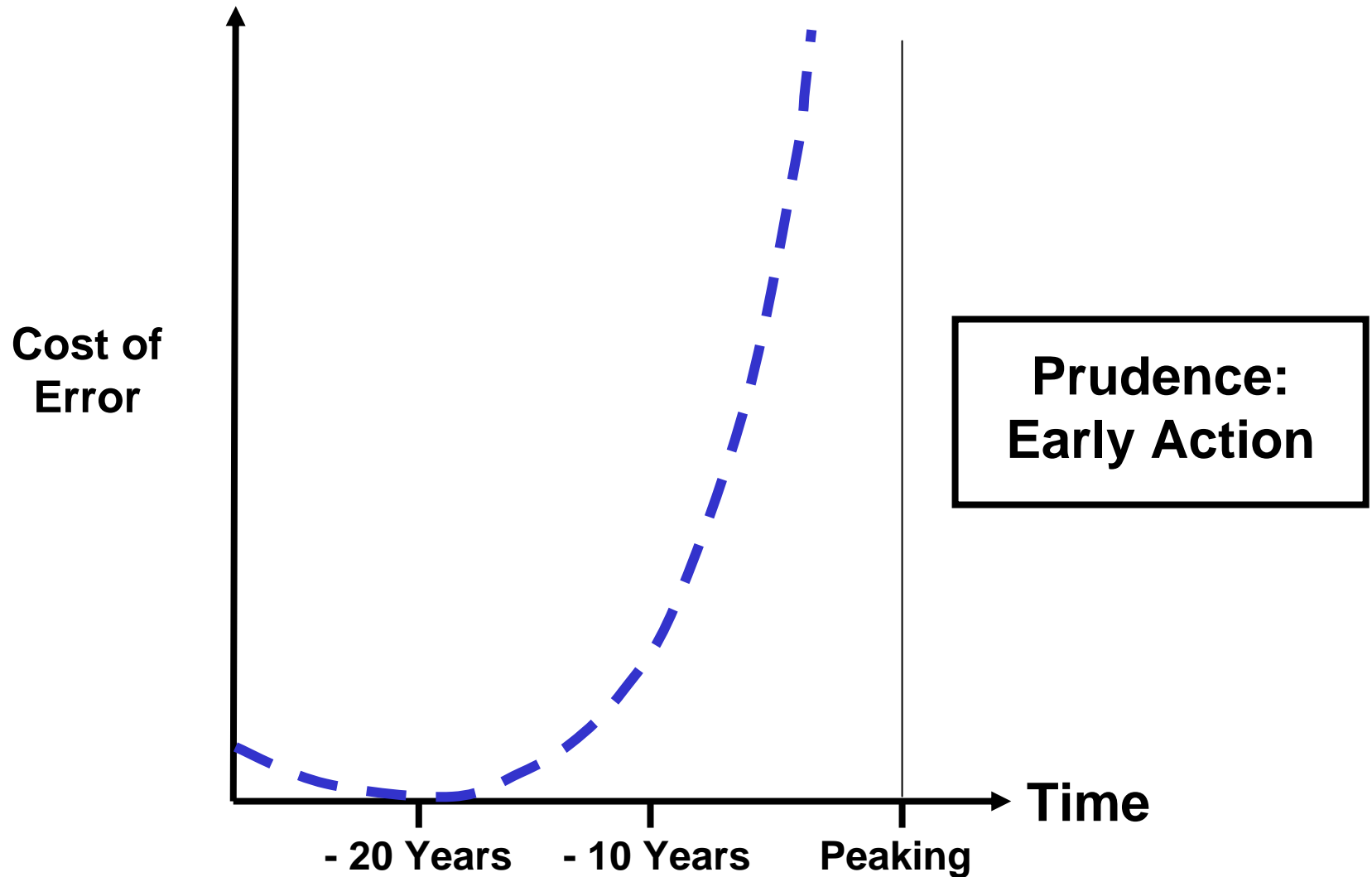
**Scenario
III**

Impacts

- **Most relevant experience: 1973 & 1979 oil interruptions.**
 - + Inflation
 - + Unemployment
 - + Recession
 - + High interest rates
- **1973 & 1979 were brief / supplies quickly restored.**
- **World oil peaking without timely mitigation could last a decade or more.**

The world has never faced a problem like oil peaking.

With an uncertain peaking date, what to do?



Summary & Conclusions

- There's unprecedented trouble ahead in world oil.
 - Peaking of conventional oil is unavoidable
 - Timing is uncertain.
 - Warning could be very short.
- It's a liquid fuels problem, not “energy”.
- Mitigation technologies are available, but it will take time for implementation.



Post Script

Without timely mitigation:

- Huge energy prices
- Oil shortages
- Inflation
- Recession or worse
- High unemployment
- Bankruptcies

Peak oil could easily trump climate change.



It can happen.