

Can bioenergy fill the gap?

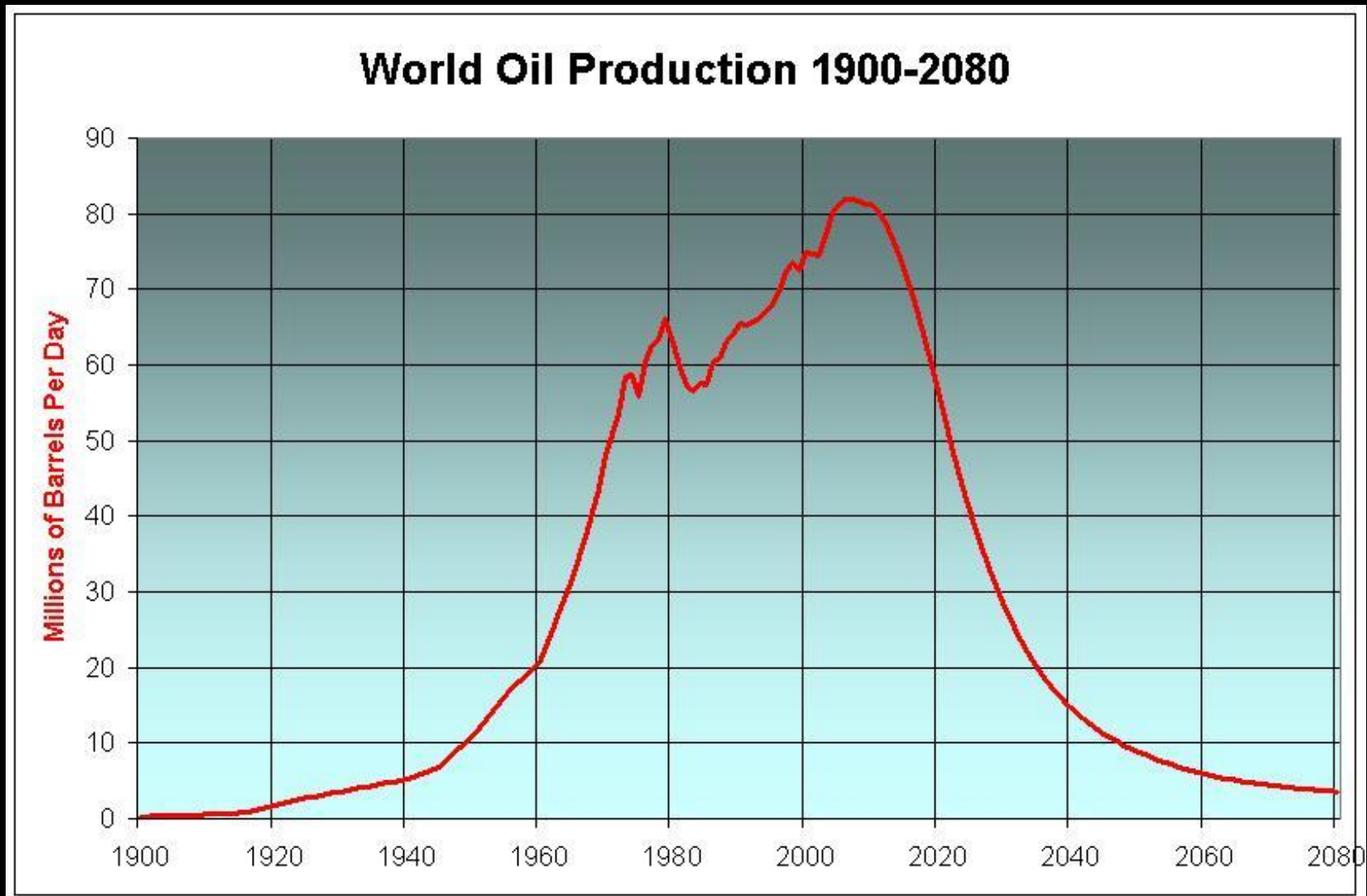
The promise and perils of bioenergy

Likely economic impacts of declining
energy availability

Alternative futures: two views

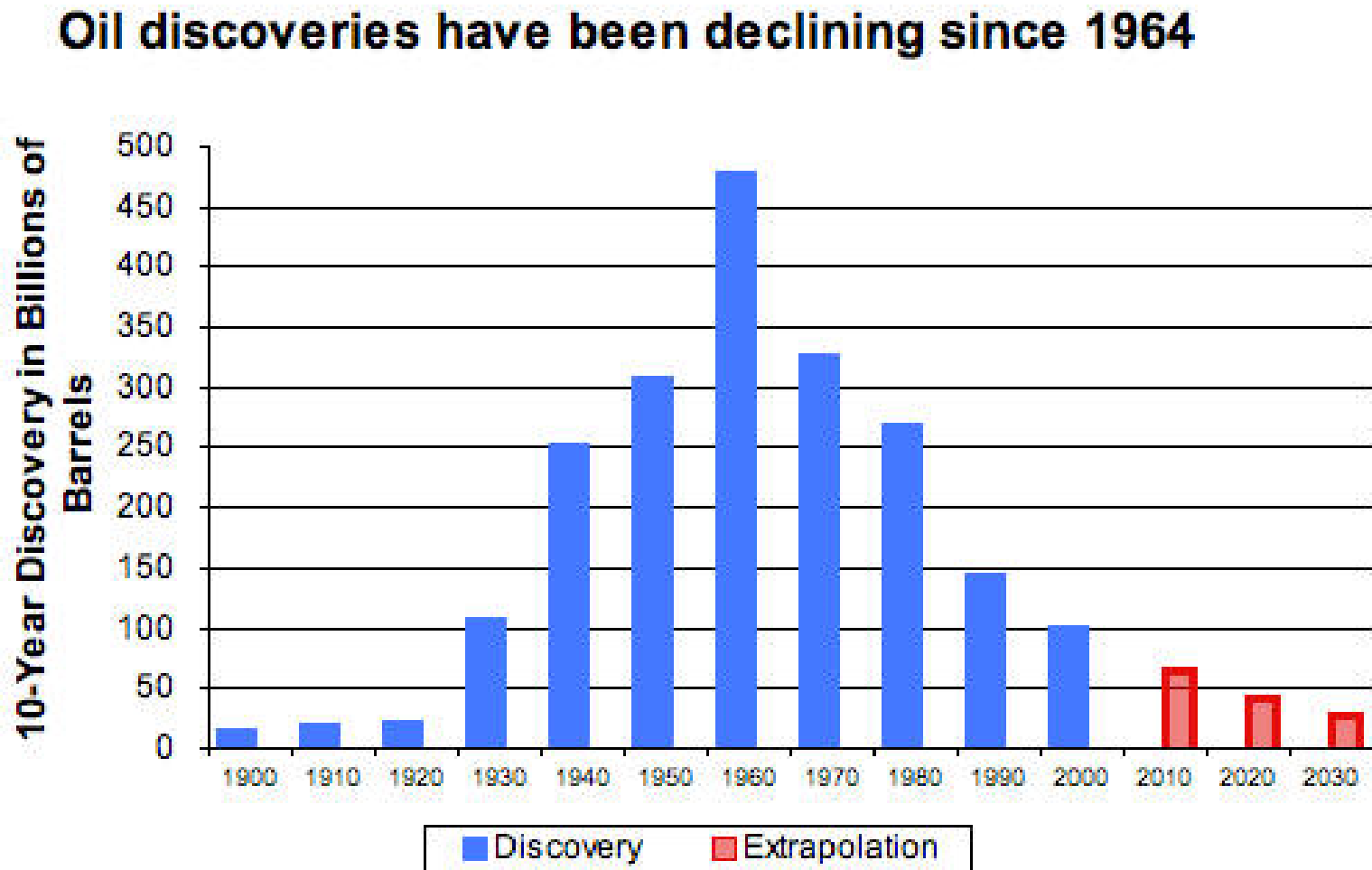
Filling the gap

Peak *extraction* of crude oil occurred in 2005



Filling the gap

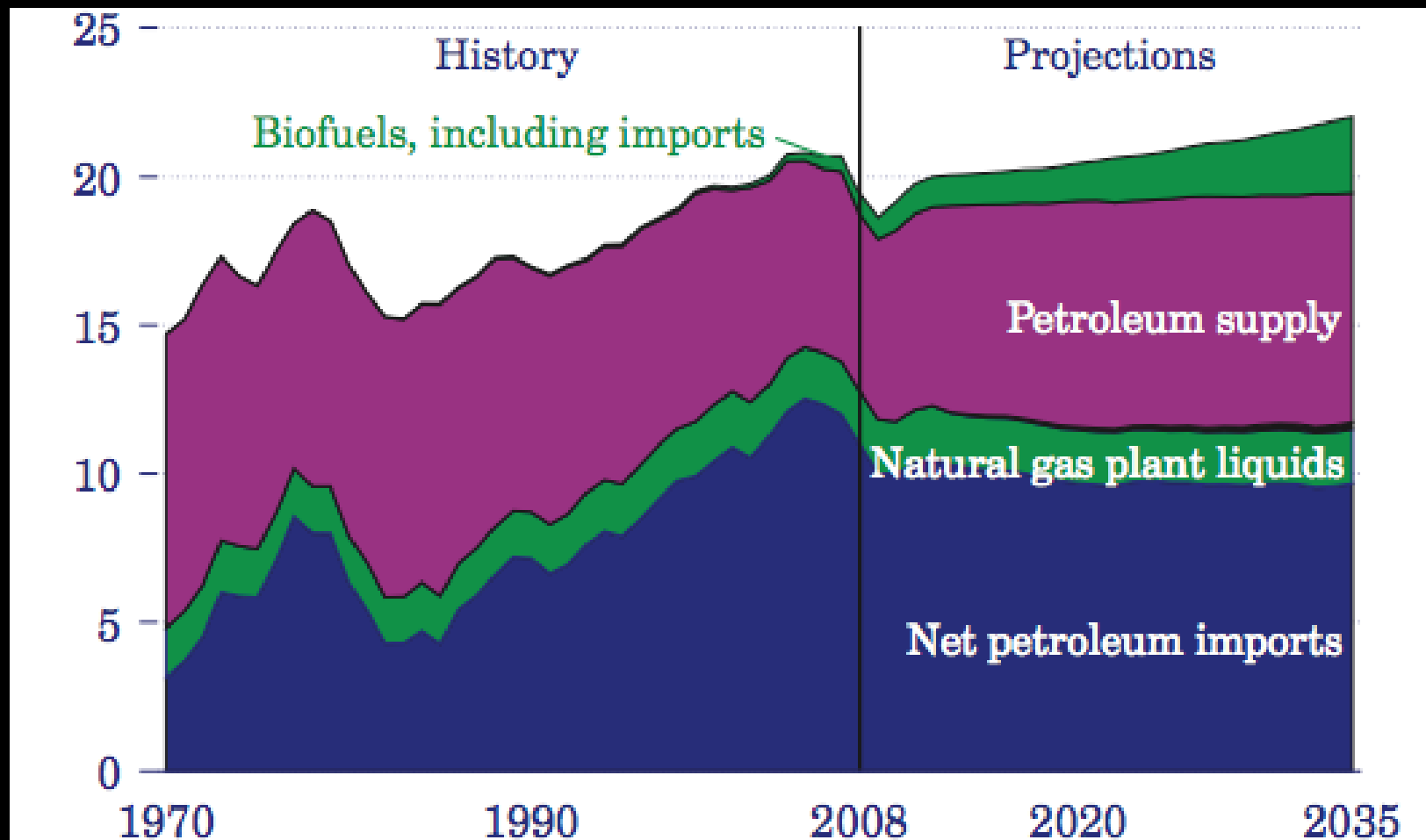
Peak *discovery* of crude oil occurred in 1964



Note: World oil discovery over 10-year periods, by Association for the Study of Peak Oil and Gas.

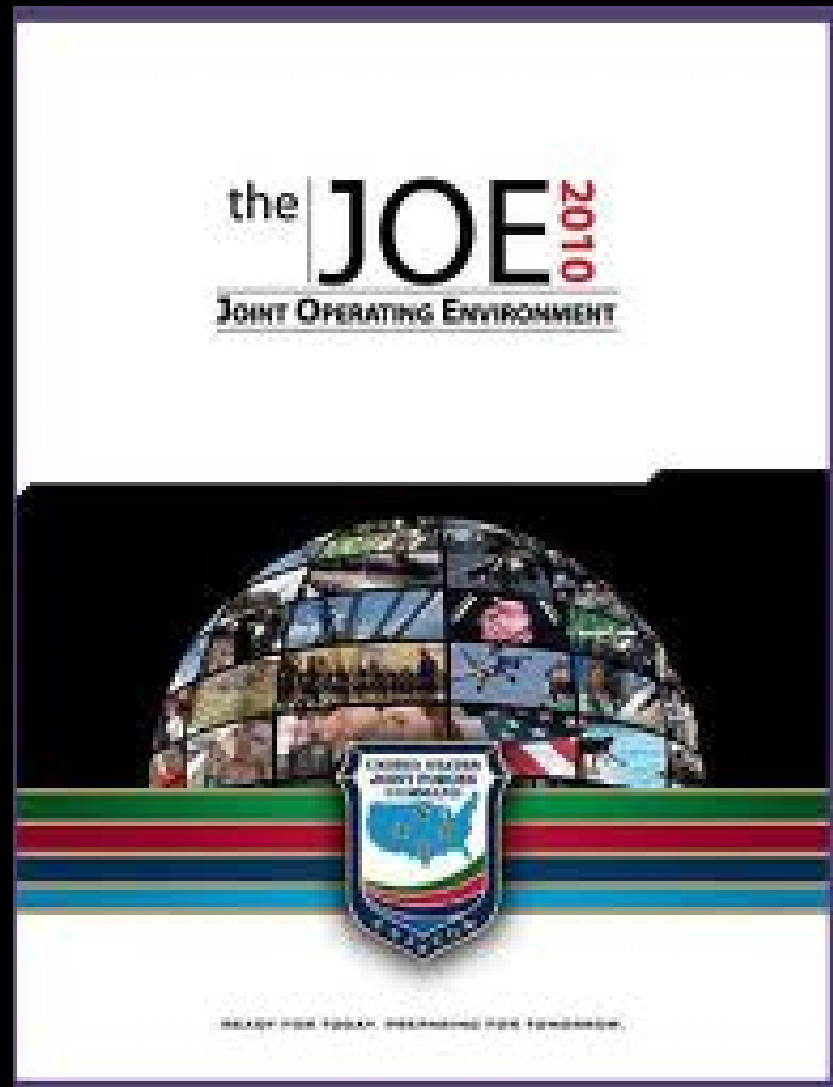
Filling the gap: the promise

IEA forecast



Filling the gap: the promise

10 mbpd gap by 2015



Filling the gap: the promise

10 mbpd gap by 2015

Union of Concerned Scientists: biofuel production
tripled 2005-2010

Tripling again by 2015 = 2.3 mbpd

2015 deficit = 7.7 mbpd

Filling the gap: the perils (lack of supply)

All bioenergy is *derived* from crude oil (cf. substitution)

Crude oil accounts for 85% of the world's transportation fuel*

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In U.S., 130,000 vehicles use natural gas (U.S. fleet = 245 million)

In U.S., ~25% of vehicles use diesel (hence, could use biodiesel)

Filling the gaps: the perils (EROI)

Energy Return On Investment
>3.0 needed for transportation fuels*
Ethanol ~ 1.0*

Algal biofuel \$9 to \$35 per gallon⁺

*Murphy et al. (2010) *Environment, Development & Sustainability* 12:

+Robert Rapier (2010): <http://oilprice.com/Alternative-Energy/Biofuels/Next-Generation-Biofuels-5-Near-Term-Challenges.html>

Filling the gaps: the perils (environmental)

Conventionally produced biofuels produce up to 420X carbon emissions of fossil fuels*

Manomet Center for Conservation Sciences: “worse than coal”

*Crutzen et al. (2008) *Atmos. Chem. Phys.* 8:389-395; Fargione et al. (2008) *Science* 319:1235-1238; Searchinger et al. (2008) *Science* 319:1238-1240

Filling the gaps: the perils (environmental)

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Biodiversity losses accelerate relative to traditional fuels**

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It is far more efficient to grow grain for food than for fuel (ethanol industry expects 50% of U.S. corn to be used for fuel by 2015)⁺

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Converting all U.S. agricultural land to production of biofuels would supply ~25% of our fuel⁺⁺

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Biofuels consume enormous quantity of water, reduce water quality[#]

[#]Dominguez-Faus et al. (2009) *Environmental Science & Technology* 43:3005-3010

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Biofuels contribute to increased size of “dead zone” in Gulf of Mexico^{##}

Filling the gap: the perils (social)

Biofuels drive African farmers off their land (investors, government displace farmers for biofuel)*

Filling the gap: summary of the perils

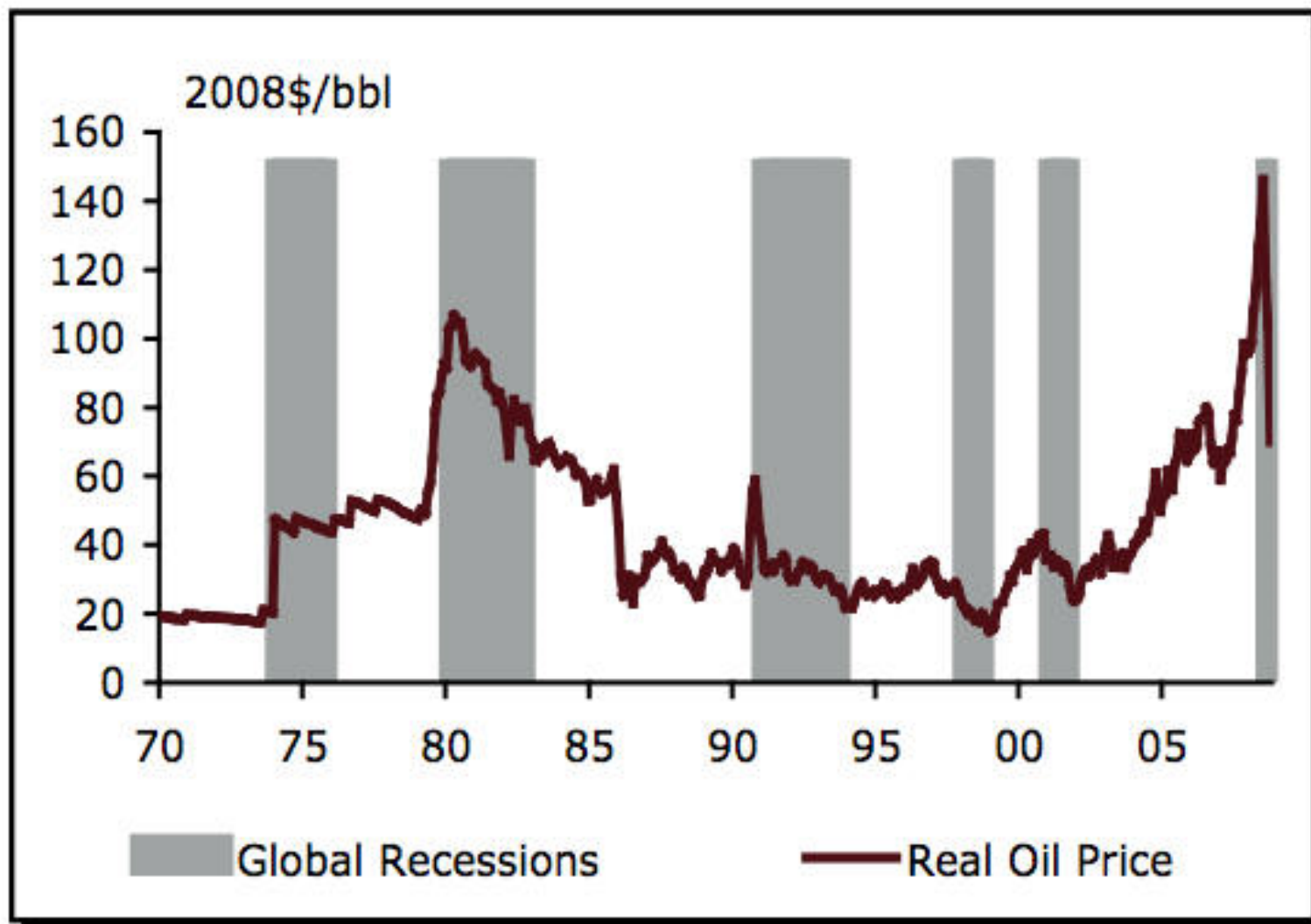
“US biofuel policies will fail to achieve the intended environmental, energy and agricultural goals”

Alternative futures

“More than any other time in human history, mankind faces a crossroads. One path leads to despair and utter hopelessness. The other, to total extinction. Let us pray we have the wisdom to choose correctly.”

Likely economic impacts of energy decline: the “despair and utter hopelessness” path

Past Recessions and Oil Spikes



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Crude oil prices 2005-2010



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Société Générale

(November 2009)

Prepare for global economic collapse within two years

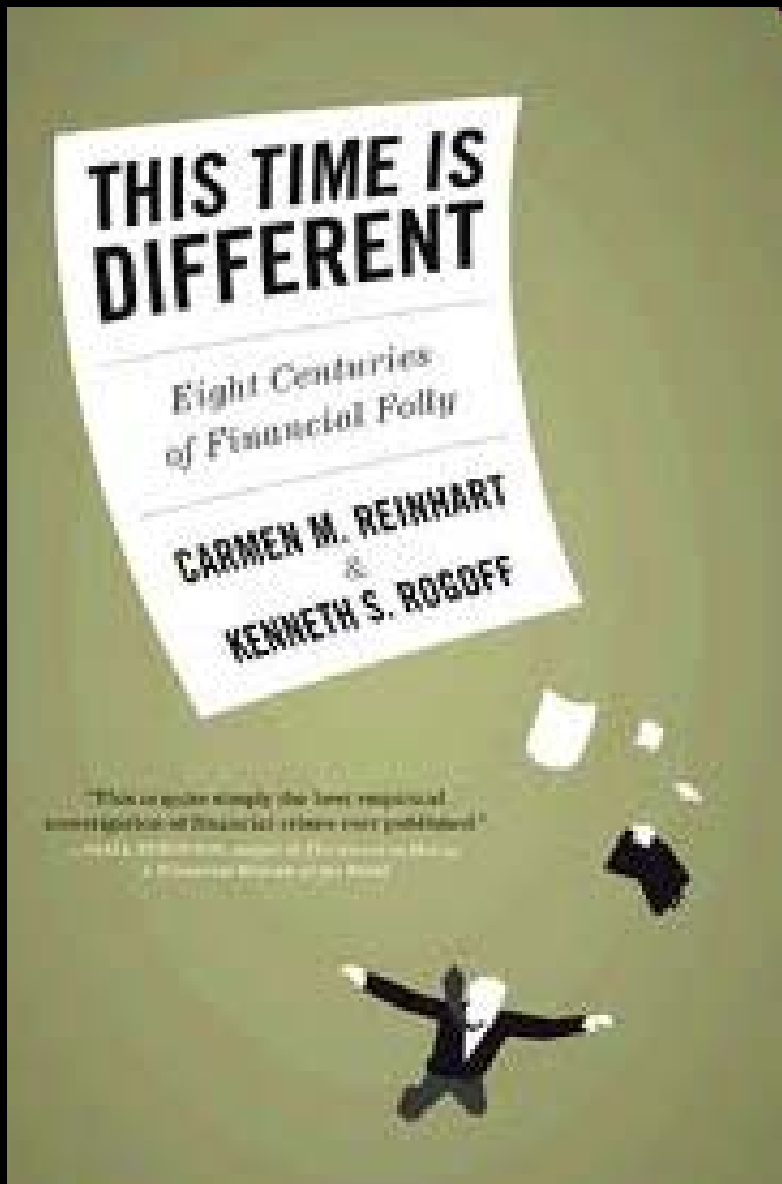
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Prepare for global economic collapse by November 2011

Michael Ruppert, Rice Farmer, Kurt Cobb, Karl Denninger, Rob Viglione, Bill Bonner, Gerald Celente, Jeff Rubin, John Michael Greer, Matt Savinar, CNBC, Catherine Austin Fitts, Charles Munger, Gonzalo Lira, Joe Bageant, Dave Cohen, Jan Lundberg, Matt Simmons (recently deceased), Chris Hedges, Dmitry Orlov, Michael Snyder, Nicole Foss, Paul Craig Roberts, Marc Faber, Bill Bonner, James Wesley Rawles, Tony Robbins, Nouriel Roubini, Max Keiser, Tyler Durden, Chris Martenson, James Kwak, Simon Johnson, Chris Clugston, Kenneth Deffeyes, Samsam Bakhtiari, James Howard Kunstler, Bob Chapman, George Ure, Laurence Kotlikoff, Igor Panarin, Joseph Meyer, Harry Dent, John Williams, Richard Russell, Niño Becerra, Martin D. Weiss, Eric deCarbonnel, Robin Landry, John P. Hussman, Robert Prechter, Richard Mogey, Peter Schiff, Hugh Hendry, Lindsey Williams, Arthur Laffer, Niall Ferguson

Likely economic impacts of energy decline: the “despair and utter hopelessness” path



> 250 financial crises
66 countries
800 years

Likely economic impacts of energy decline: the “despair and utter hopelessness” path

Greatest Depression

Massive unemployment (~100%)

Fiat currency worth less and less

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Very little gasoline, diesel

Likely economic impacts of energy decline: the “despair and utter hopelessness” path

Greatest Depression

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No food in the grocery stores

No fossil fuels for A/C or heat

No water from municipal taps

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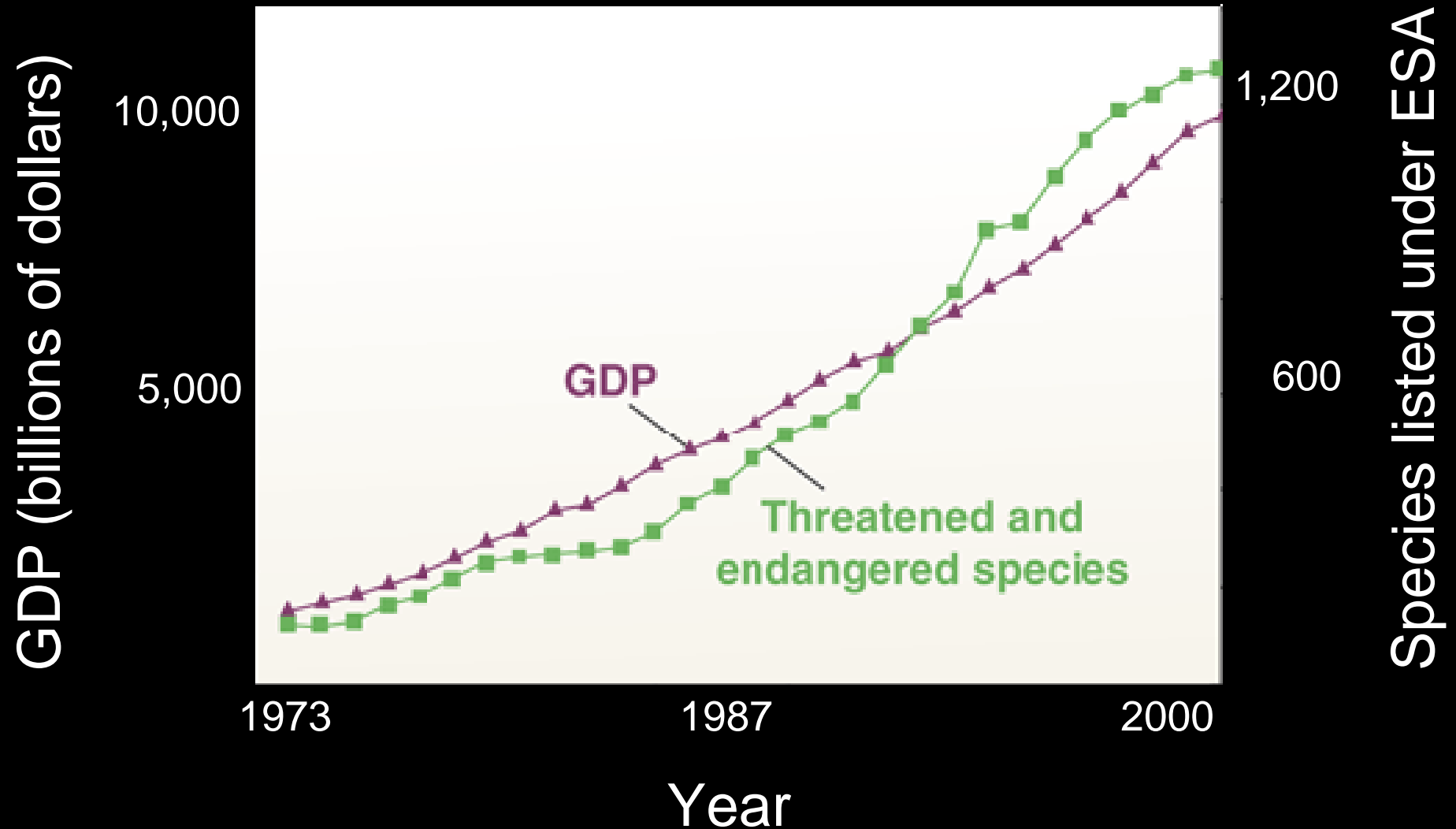
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NO WESTERN CIVILIZATION

Likely economic collapse: actually, it's good news



Economic scenario: extinction (i.e., BAU)



Consume

1. To do away with completely; destroy
- 2a. To spend wastefully; squander
- 2b. Use up
3. To waste or burn away; perish

Economic scenario: BAU



Economic scenario: BAU

The trouble is that once you see it, you can't unsee it. And once you've seen it, keeping quiet, saying nothing, becomes as political an act as speaking out. There's no innocence. Either way, you're accountable.

Arundhati Roy (*Power Politics*, 2001)

Climate chaos

Intergovernmental Panel on Climate Change

late 2007: *1 C by 2100*

Hadley Centre for Meteorological Research

late 2008: *2 C by 2100*

United Nations Environment Programme

mid 2009: *3.5 C by 2100*

Hadley Centre for Meteorological Research

October 2009: *4 C by 2060*

Global Carbon Project, Copenhagen Diagnosis

November 2009: *6 C, 7 C by 2100*

Climate chaos

Proceedings of the National Academy of Science:
Climate change is irreversible
(10 February 2009)

United Nations Environment Programme:
During 2008, global carbon emissions increased
(November 2009)

Climatic Change: Only economic collapse will prevent
runaway global climate change

(21 November 2009)

Climate chaos trumped by economic collapse?

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**Economic
collapse**

Can bioenergy fill the gap?

No, fortunately

Perils > Promises

Better days ahead, sans bioenergy

guymcpherson.com