

ISSUE BRIEF

# Meeting the World's Natural Resource Needs: Confrontation (or Worse) Ahead?

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## **Resources for the Future**

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## Meeting the World's Natural Resource Needs: Confrontation (or Worse) Ahead?

Joel Darmstadter<sup>1</sup>

It's not uncommon, these days, for talk about oil and other energy and nonenergy resources to shift to concerns about "running out" and—not far behind—a confrontational scramble to gain access to what's left for the picking. Before such visions become mainstream thinking, a bit of perspective might help clear the air—namely, a reminder that we've been down this path before. Every few decades, it seems, some event or conjunction of events creates enough anxiety to prompt questions about whether natural resource scarcity and its economic consequences constitute a looming and worrisome threat.

To be sure, there are times when such anxiety is driven by circumstances that are anything but trivial. One example: the Paley Commission's 1952 report, *Resources for Freedom*, looked at the nation's resource needs and adequacy at a time when the memory of World War II shortages, the ongoing Korean War, and the intensifying Cold War did not allow policymakers to take a relaxed view of what might be in store for the country amid growing international tensions.<sup>2</sup>

But then, let's accept the fact that the world is not a persistently serene and placid place. Convulsions and volatility do occur—and yet often they do not, in retrospect, turn out to have justified the overreaction and policy excesses they engendered. The Arab oil embargo of 1973–74 and the Iranian revolution of 1979–80 were invoked not only to support the perversely damaging control of oil markets instituted some years earlier but also to lay the groundwork for a multibillion-dollar government-sponsored effort—mercifully soon abandoned—to augment conventional oil resources with synthetic fuels. That the oil price increases of the 1970s were

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<sup>2</sup> *Resources for Freedom*, Report of the President's Materials Policy Commission, June 1952. The establishment of Resources for the Future (RFF) later that year was a direct outgrowth of the recommendations and thrust of the commission.



followed by sharply lower prices in the mid-1980s and beyond offers a chastening reminder of the need to distinguish between transitory events—however disruptive—and major discontinuities requiring fundamental course corrections in policy.

In short, although the past may not foretell the future, neither should some past lessons be casually dismissed. Drawn on judiciously, they can help illuminate today’s debate about constraints to worldwide economic well-being posed by the costs and uncertain availability of natural resources. I will first address the topic of oil markets and follow with a look at two nonfuel resources.

## The Oil Conundrum

To write, in June 2011, that crude oil generally and gasoline in particular are sources of public alarm and news headlines is an exquisite understatement. But the issues connected therewith are anything but straightforward: rising prices, political upheavals in the Middle East, and energy requirements to sustain rapid rates of economic growth in China, India, Brazil, Russia, and elsewhere.

Is that surge in demand for oil so potent as to explain T. Boone Pickens’s statement that “[a] global race for energy is on—and China is way out in front,” or to allow even the more restrained *New York Times* to employ a battlefield metaphor to characterize a Chinese stake in an Argentine offshore oil venture as a “beachhead”?<sup>3</sup> This sort of language can easily lead to the alarming evocation of “resource wars” and, by extension, the assumed inevitability of a decline in oil production that threatens economic harm. And the Pickens image might be interpreted to indicate a Chinese effort to gain preemptive control—to “lock in”—energy resources (with which the country is poorly endowed domestically), suggesting in turn a kind of zero-sum state of affairs: success in such an effort would presumably occur at the expense of other countries.<sup>4</sup>

But let’s not conflate two distinct phenomena: on the one hand, the scarcity (whether enduring or transitory) of a resource, signaled by real costs and market prices; on the other, a threatened shortage of such magnitude as to prompt a consuming country to seek dominant command over that resource. Yes, continuing, rapid, and spreading economic growth could strain global oil supply, necessitating higher real prices to bring demand and supply into balance (by both restraining consumption and encouraging new supply development). But such higher prices would confront *all* consuming countries—China included—whether or not their oil needs are satisfied by domestic production or imports and whether or not such imports originate in their own overseas

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<sup>3</sup> The Pickens quote is from his column (coauthored with Dan Di Micco) “Long-Term Vision Should Include Offshore Drilling,” *Politico*, July 21, 2010; the *New York Times* reference is to “Deal for South American Oil Fields Extends China’s Quest for Energy,” March 15, 2010.

<sup>4</sup> Although China serves as the emblematic case of issues discussed throughout much of this paper—the country’s economy is, after all, the world’s largest or second-largest (depending on GDP measurement conventions), with growth rates close to double-digit—the problems of trade, investment, and resource demands aren’t singularly applicable to that country.



assets. Consistent with that observation, a recent study by Theodore Moran, an international business professor at Georgetown University, concludes that “evidence from the 16 largest Chinese natural resource procurement arrangements shows that Chinese efforts predominantly help expand and diversify the global supplier system ... [And in] the sector most crucial for China’s procurement strategy—access to international oil—Chinese companies have not diverted oil supplies toward the Chinese domestic market but instead sold the supplies they controlled predominantly [in] international markets.”<sup>5</sup>

Still, that finding doesn’t undermine the logic of China’s offshore resource acquisitions. Higher oil prices might yield higher and more certain returns than other investments and, in addition, provide a kind of hedge against the cost increases facing China’s own oil-intensive industries. And there are no doubt other factors in China’s quest for offshore oil and other properties. Who is to say that preferential treatment accorded Chinese exploratory companies in Sudan does not yield a quid pro quo in the form of China’s noncommittal stance at UN Security Council proceedings on Sudan’s human rights record? Also, a growing overseas presence with joint equity partners may provide China with enhanced export opportunities and diversified technological expertise.<sup>6</sup>

Putting all this together, it seems premature to characterize things in the somewhat hyperbolic terms chosen by Pickens and their implicit but ominous stretch to the evocation of “peak oil,” let alone the specter of resource wars.

## Nonfuel Minerals

To see how some of the issues considered in the oil discussion apply in the nonfuels area, here are two illustrative cases. The first, and more conventional example, is copper; the second, less conventional but the subject of intense disputation, involves “rare earths.”

As a general proposition, **copper**—a nonrenewable commodity whose ease of extractability, absent technological progress, recedes with time—shares attributes of oil, including the questionable feature of “peaking.” In an admirable 2003 RFF Press book, *On Borrowed Time? Assessing the Threat of Mineral Depletion*, John Tilton, of the Colorado School of Mines and affiliated with Resources for the Future, shows how the real price of copper has been on an unmistakable downward path for the past 130 years, never mind periodic volatility along the way (Figure 1.) Evidently, whatever the pressures from depletion to drive up costs, the cost-reducing effects of technological progress can more than compensate for such a trend. But there’s more: if such technical progress is inadequate to sustain availability of high-grade copper deposits, even that prospect needn’t be—in Tilton’s words— “particularly interesting, or relevant, for sustainable

<sup>5</sup> Theodore Moran, *China’s Strategy to Secure Natural Resources: Risks, Dangers, and Opportunities* (Washington, D.C.: Peterson Institute for International Economics, 2010), 46.

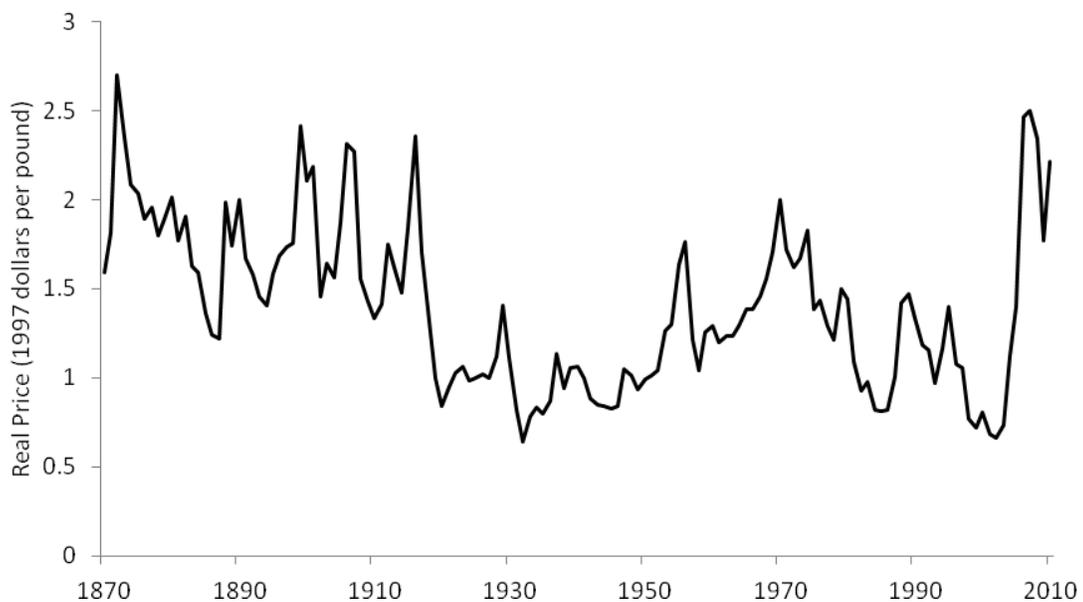
<sup>6</sup> The complexity of these and other factors motivating Chinese offshore investments—especially in Africa—is concisely explored in *The Economist*, April 23, 2011.



development and the welfare of future generations. The important question is whether society will be able in the future to provide the needs currently being served by these high-quality mineral deposits from other resources at real prices close to or even below those that currently prevail” (121).<sup>7</sup> Thus, as just one example of how a substitute raw material can provide an end product or service formerly dependent on what seemed to be a unique mineral, fiber optic transmission has replaced reliance on copper wire. And society’s well-being has not only not diminished but probably risen.<sup>8</sup>

**Figure 1.**

Copper Prices at Refinery, 1870-2010



Source: For 1870–1997, from John Tilton, *On Borrowed Time: Assessing the Threat of Mineral Depletion* (Washington: Resources for the Future, 2003), 126; for 1997–2010, based on real copper price data in United States Geological Survey, *Mineral Commodity Summaries*, various issues.

The topic of **rare earths** also involves China as a convenient point of departure, though with some unique twists that stand in contrast to the situation with oil. The rare earths issue, to which many people were alerted only in October 2010, with Japan’s detention of a Chinese trawler captain and China’s retaliation by suspending rare earth exports to Japan, confronts us with a whole set of fascinating aspects. These embrace natural resource markets, trade and investment policy, and— not far removed—effects on other countries, including, not least, the United States. Although rare

<sup>7</sup> John Tilton, *On Borrowed Time? Assessing the Threat of Mineral Depletion* (Washington, D.C.: RFF Press, 2003), 121.

<sup>8</sup> And this example doesn’t even consider the use of recycled copper scrap as a means of extending the “life” of the resource. Although thermodynamic limits inhibit analogous “recycling” of fuels, there are conversion processes—such as the reuse of waste steam in combined-cycle gas turbine-steam turbines—available even in electricity generation applications.



earths can't begin to match international oil transactions in quantitative and economic significance, their potential for stirring conflict and tension may be as real.

Rare earths are more than a dozen elements in the periodic table, primarily spanning atomic numbers 57 through 71, with magnetic and other properties. Their names, inspired by—among other things—Greek mythology (promethium), place names (scandium), and scientists (gadolinium), hardly enjoy everyday familiarity. But the energy and other systems and products to which they constitute critical inputs couldn't be more familiar: batteries, lasers, computer memory, medical equipment, and photographic lenses are just a limited sampling. They have an especially vital role in energy applications, such as wind turbines.

Although their worldwide geologic occurrence is indisputably abundant, a combination of factors—some more speculative than others—have resulted in China's being the only significant producer of these important materials. (Recently, the American producer Molycorp has announced plans to resume measurable production, after having shuttered its facility years ago.) China's preeminence raises, among other issues, questions about the actual or potential exercise of market power, production costs (real or subsidized), environmental impacts (external or internalized), and China's evident interest in parlaying its dominance as leading producer into achieving added value on top of its returns from raw material extraction—proceeding from the upstream stage to the benefits of fabrication and, still further downstream, to the capacity for manufacturing the finished equipment (e.g., wind turbines) of which rare earths have turned out to be an especially important building block. It's easy to appreciate China's added-value goal. The value of rare earths at the extraction stage represents a tiny percentage of the value of the final product in which they're embedded. Tripling the price of rare earths hardly alters the cost, say, of a turbine or battery.<sup>9</sup> Genuine profitability lies elsewhere—a fact that understandably motivates America's added-value goal as well.

In an idealized market paradigm, China's status as a quasi-monopolist would be competed away as other rare earth producers revived or started up extraction. But suppose China, through subsidization, along with a willingness to undervalue environmental protection, seeks to foreclose that outcome. (Export controls might additionally come into play.) Suppose further that, as it proceeds to enter the high-value stage of manufacturing rare earth-dependent equipment, China deploys preferential loans conditioned on domestic content requirements. To be sure, international trading rules and recourse through World Trade Organization (WTO) appeals and retaliatory threats and action by affected countries could frustrate such impulses and restore a

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<sup>9</sup> After indicating how some rare earth prices have doubled during the first four months of 2011 after quadrupling during 2010, a May 2 *New York Times* story ("Supplies Squeezed, Rare Earth Prices Surge") notes that consumers of goods containing rare earths "will barely note the soaring cost..." <<http://www.nytimes.com/2011/05/03/business/03rare.html?ref=business&pagewanted=print>>.



degree of fair trade behavior.<sup>10</sup> On the other hand, for what some would see as a disquieting element in such a standoff, consider this recent passage in a *ClimateWire* release, quoting Robert Howse, a law professor at NYU: “Provisions under Chinese law mandating that nearly all wind power equipment be purchased from China for projects to be eligible for state financial support are facing a WTO challenge by the United States .... But the WTO panel and appellate body have explicitly shown in the past that they will allow exceptions for environmental protection. And if Beijing could convince the trade body that the domestic content requirement is necessary to help curb global climate change, the WTO board may toss out the U.S. complaint ...”<sup>11</sup> (Might there lurk here a comically surreal situation in which the putative neglect of environmental stewardship in extracting the raw material allows the authorities to suddenly and opportunistically find environmental religion downstream that saves the day? Recall the definition of *chutzpah*: the kid who murders his parents but pleads for mercy as an orphan!) Indeed, China’s environmental rare earth toll was vividly underscored by Prof. Robert Jaffe of MIT, in remarks at an American Enterprise Institute symposium on April 6, 2011.<sup>12</sup>

In the U.S. domestic context, in which green energy’s contribution to economic revival and job creation are an ever-present theme of the Obama Administration, the seriousness of such a U.S.-Chinese trade impasse—coming, as it does, on top of persistent and broader disputation over Chinese trade and currency practices—shouldn’t be reckoned as trivial. So, rare earths—themselves, as noted earlier, a negligible factor in the cost of a wind turbine or other equipment—may be a harbinger, and maybe a healthy one, of more widespread trade and investment dilemmas that deserve to be addressed.

## Summing Up

This has been a hasty run-through across several disparate sets of natural resources. Although my consciously straw-man title suggested that it was physical scarcity that might threaten and precipitate conflict, it seems, in fact, that the seeds of such conflict may more likely arise from various trade-distorting ways in which nations seek to gain competitive advantage over one another rather than from the more widely sounded refrain of running-out—with peak oil its iconic example. If there are battles looming, they may well be fought in the corridors of the WTO in Geneva—not in the oil patch—as claims and counterclaims of unfair commercial practices are argued out.

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<sup>10</sup> Protests against unfair Chinese trade policies have been alleged for other commodities—for example, export subsidies or dumping practices in the case soda ash and magnesia bricks. Such charges have originated not only in the United States but have been leveled as well by India and the European Union.

<sup>11</sup> “Clean Tech: China May Have Grounds to Defeat U.S. WTO Case over Wind Turbine Subsidies—Experts,” *ClimateWire*, April 4, 2011.

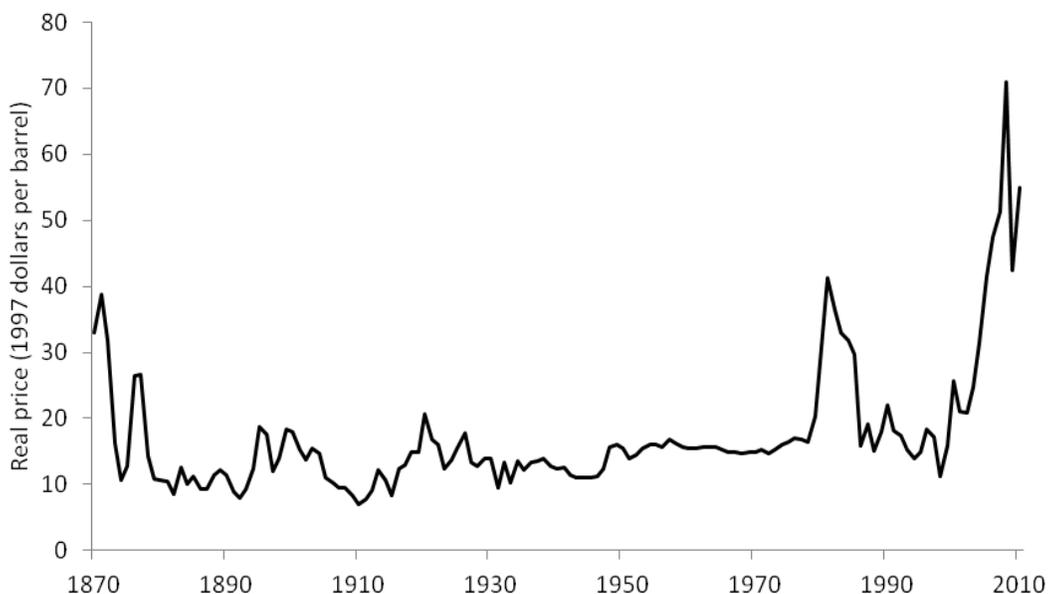
<sup>12</sup> The problem was also flagged in the study “Energy Critical Elements: Securing Materials for Emerging Technologies,” a joint report by the American Physical Society and the Materials Research Society (2010, 12). Prof. Jaffe chaired the committee producing that study. For particulars on the AEI event (“A Rare Earth Crisis?”) at which Prof. Jaffe and others spoke, go to <[www.aei.org/event100385#doc](http://www.aei.org/event100385#doc)>.



So, to revert to energy and oil, what might be said about short-term market turmoil and the economic and social distress they're clearly causing? Is \$110-a-barrel oil the immutable floor price that we might as well get used to? With a bit of perspective, think about how the natural gas price spike of the 1990s gave little hint of the shale gas bonanza and low prices we're now experiencing. And, as indicated at the outset, the oil market turmoil of the 1970s hardly turned out to be the leading indicator of an inexorably rising price trajectory. Indeed, over a much longer historical timespan, the real petroleum price trend has been close to flat, never mind the volatility surrounding that trend (Figure 2).

**Figure 2.**

Petroleum - U.S. Average Value, 1870-2010



*Source:* For 1870–1997, from Tilton, *ibid.*, p. 134; for 1997–2010, based on real oil price data in U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2010* and *Annual Energy Outlook 2011*.

All that said, these reassuring lessons from the past are not preordained to hold for the future. Consider: we probably face recourse to less hospitable and costlier producing regions; there looms the imperative of mitigating greenhouse gases and other environmental risks; and a progressively more skewed geographic concentration of oil resources, reserves, and market dominance in production capacity seems likely. With all such factors playing out amid rapid



economic growth in many parts of the world, the situation could presage a global oil profile significantly different from that of the past.<sup>13</sup>

Weasel words like “could,” “may,” and “possible” betray a tentativeness in spotlighting one preclusive path of development. The safest plea I can utter is that both those who see fundamental discontinuities in the years ahead and those who are much more sanguine about the sustainable extension of past trends must accept the burden of sharing the basis of the premises, assumptions, and analysis governing their respective visions of the future.

But to give those with a pessimistic slant their due, it may in fact be worth asking, as with the task assigned to the Paley Commission in the early 1950s, might it be timely to consider undertaking another major reconnaissance of U.S. and global resource prospects and problems? Indeed, that seems to be a major thrust of the “critical materials bill,” proposed in April 2011 by Sen. Murkowski (R.-Alaska), with a directive to the secretary of the Interior to draft a “methodology for determining which minerals qualify as critical minerals based on an assessment of whether the minerals are (1) subject to potential supply restrictions (including restrictions associated with foreign political risk, abrupt demand growth, military conflict, and anti-competitive or protectionist behaviors; and (2) important in use (including clean energy technology-, defense-, and health care-related applications.” (Title I, Section 101)<sup>14</sup>

Woody Allen’s much-cited expression of angst—here loosely paraphrased—sees mankind at a crossroads that, in one direction, leads to wholesale disaster, and in the other, utter calamity, prompting him to hope that we’ve got the sense to choose wisely. In energy and resources, the choices aren’t both quite so equally hopeless. The trick is to do the hard work needed to tease out the more credible and—one hopes—favorable direction in which things, in the United States and globally, are likely to go.

## Suggested Readings

American Physical Society and Materials Research Society. 2010. *Energy Critical Elements: Securing Materials for Emerging Technologies*. Joint report. Publication available for download from [www.aps.org](http://www.aps.org).

*Economist*. 2011. “Briefing: The Chinese in Africa.” April 23, 73–75.

Moran, Theodore H. 2010. *China’s Strategy to Secure Natural Resources: Risks, Dangers, and Opportunities*. Washington, D.C.: Peterson Institute for International Economics.

<sup>13</sup> Alberta’s oil sands typify the yin-yang complexion of such dilemmas: they are indisputably huge in magnitude (having entered the category of proved oil reserves just a few years ago and already produced in significant volume), yet the goal of exploiting the resource with a benign environmental footprint remains a work in progress.

<sup>14</sup> U.S. Senate Legislative Counsel, Critical Materials Policy Act of 2011, draft copy, April 15, 2011.



President's Materials Policy Commission ("Paley Commission"). 1952. *Resources for Freedom*. Report to the President. (A summary of Volume I, including comments by William Paley and Hans H. Landsberg, was reissued by Resources for the Future in 1987 to mark the 35th anniversary of RFF's founding.)

Tilton, John. 2003. *On Borrowed Time? Assessing the Threat of Minerals Depletion* Washington, D.C.: RFF Press.

U.S. Department of Energy. 2006. *Energy Policy Act of 2005, Section 1837, Review of International Energy Requirements*. February.

