



POWER SHIFTS

DEMOGRAPHICS

CLIMATE CHANGE

GLOBAL FINANCIAL SYSTEM

SCARCITY

Issue Brief No. 04

The Resource Scarcity Nexus: Challenges for the 21st Century

www.worldforesightforum.org

Introduction

The consequences of natural resource scarcity are crystallizing into some of the most complex and urgent issues facing our world in the 21st century. Demographic trends, climate change, and expanding economic activities are among the key factors aggravating the scarcity of key natural resources – food, water, energy and minerals. In turn, price volatility and supply shortages threaten to increase poverty, intensify hunger, trigger domestic and international conflict, and induce economic stagnation. Realizing the severity and complexity of resource scarcity is the first step toward effectively addressing the scarcity challenges lying ahead. What makes resource scarcity an extraordinary challenge are its far-reaching global effects and the manner in which the four resources are connected (see figure 1).

Although resources are unevenly distributed across countries and regions, the adversity caused by price fluctuations and supply shortages reach all parts of the world. Furthermore, the four key resources or systems are interconnected, so changes in one system affect other

systems. In this fact sheet we review the interrelationships of food and water, energy and food, and minerals and energy. If we are to improve the management of resources and reduce the adversity caused by their scarcity, we must understand the complex reality of resource scarcity.

Food and Water Scarcity

“Water scarcity affects all social and economic sectors and threatens the sustainability of the natural resources base.” (World Water Day, 2007)

The agriculture sector is the largest consumer of water. According to the Food and Agriculture Organization (FAO), almost 70% of the water drawn from rivers and groundwater is used for irrigation, and is projected to increase by 14% between 2000 and 2030. This represents an increase in irrigated land from 202 million ha (1997-1999) to 242 million ha by 2030, only 45 million ha of which

THE RESOURCE SCARCITY NEXUS

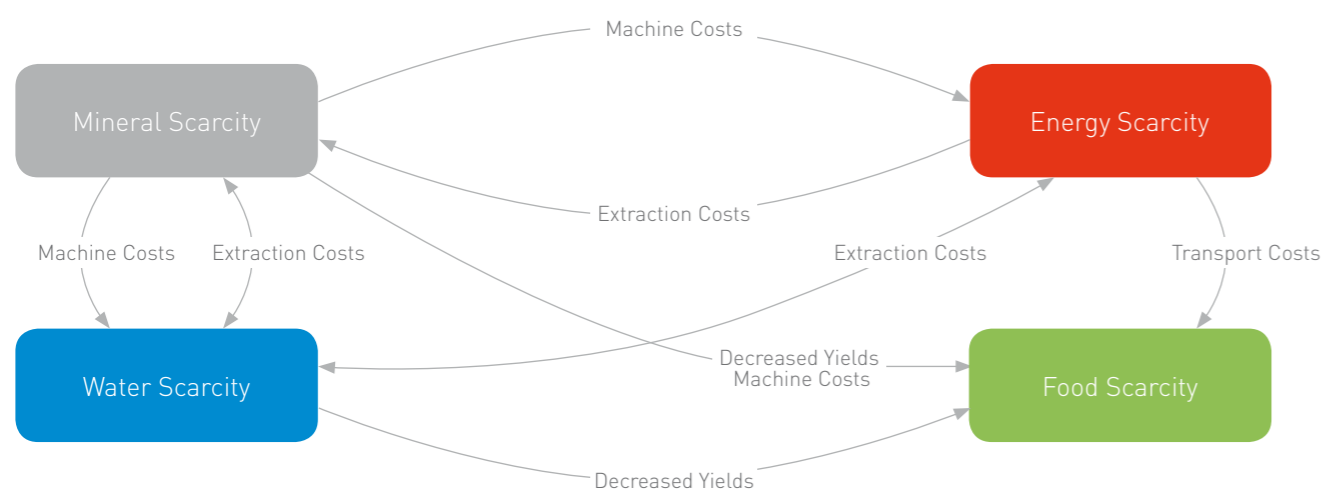
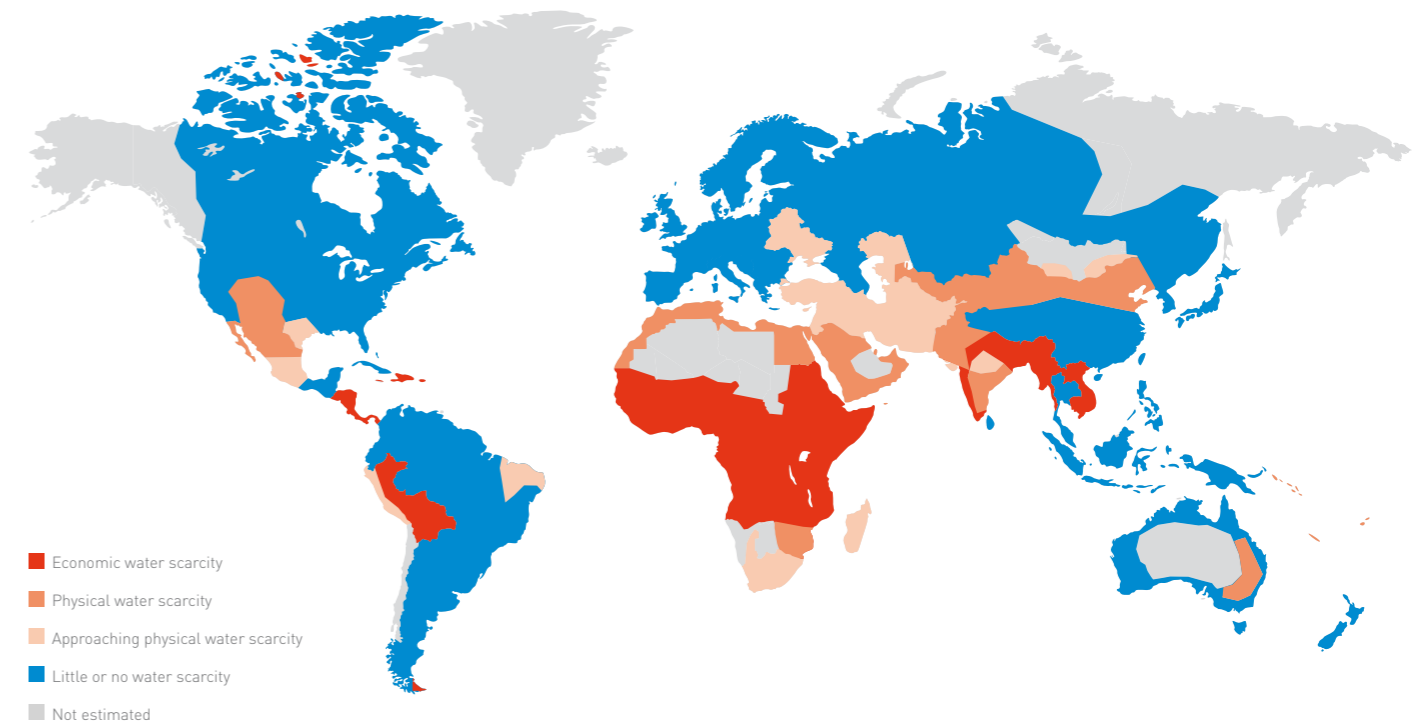


Figure 1: Resource Scarcity Nexus

WATER SCARCITY



Source: Comprehensive Assessment of Water in Agriculture, 2007.

Figure 2: Areas of Physical and Economic Water Scarcity

will be in 93 developing countries. With the importance of irrigation in food production expected to increase over the next two decades, demand for water is expected to rise despite water shortage being a major problem for many developing countries (see figure 2). Ten developing countries have already crossed the FAO threshold of 40% use of renewable water resources for irrigation, creating a shortage of water supply for municipal and industrial use. By 2030, South Asia, too, will have reached the threshold of 40%, while the Near East and North Africa will be using more than 58% of their renewable water resources.

This increase in water scarcity will inevitably have a significant impact on food supplies and prices, the latter having fluctuated dramatically in the last two years (see figure 3) after peaking in 2007/2008. According to FAO estimates, the number of people suffering from hunger increased by 75 million in 2007 due to higher food prices. A recent FAO report shows that food prices hit a record high in December 2010, surpassing the high prices of 2008. Over the last seven months prices have risen steadily, increasing by 3.4% from December 2010. According to FAO, different factors are responsible for driving up food prices, including population growth, more demand for biofuels, greater reliance on international trade, climate change, macroeconomics, and water scarcity. Over the next decade food prices are expected to rise by 40%.

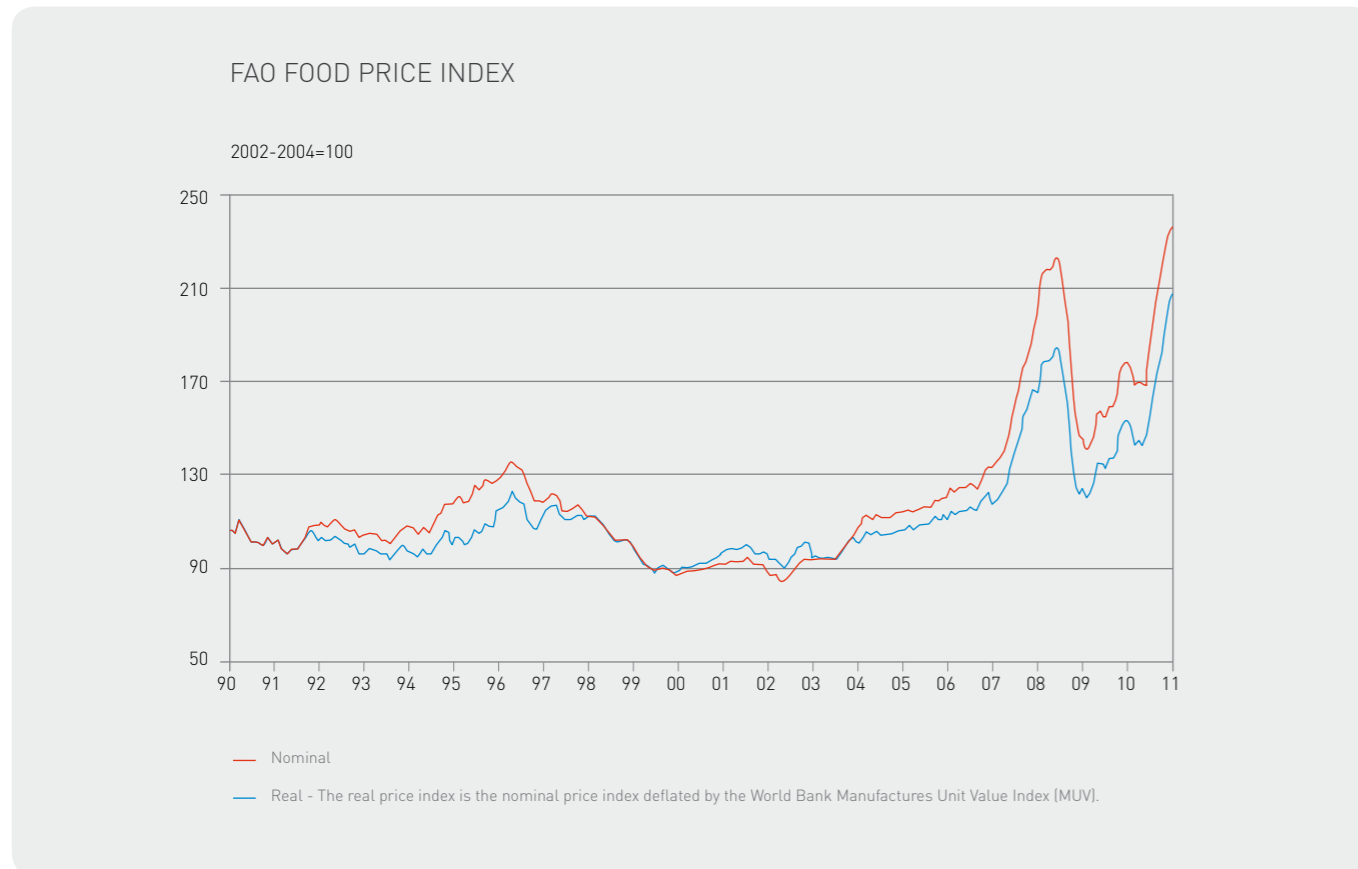


Figure 3: Increase in the FAO Food Price Index

Energy and Food

Fluctuations in the energy market impact food supplies in several ways. Not only do higher energy prices drive up transportation costs and fertilizer prices, but also energy and food are interrelated in the production of biofuels. In 2005, global ethanol production reached 9.66 billion gallons, mainly from sugar cane (45.2%) by Brazil and from corn by the US (44.5%). Moreover, biodiesel made from oilseeds reached almost one billion gallons. This rise in demand for biofuels is constraining food supplies and is considered a key contributor to the surge in food prices in 2007/2008 (see figure 3). Looking ahead, the International Energy Agency (IEA) has projected an increase in the share of biofuels to 118.5 Mtoe, accounting for 5% of the total energy required for road transport by 2030, while biodiesel is projected to grow even more than

ethanol, especially in the EU and Asia (see figure 4).

Along with the expected rising demand for food, global demand for energy and gas are also projected to increase. Oil and gas, whose share as a percentage of total energy sources is expected to decline, will remain the dominant sources of energy for the next several decades. Measured as the ratio of total imports to total consumption, dependence on oil will increase for many countries, with the largest increase in emerging economies (see figure 5). The IEA estimates a rise in dependence between 2007 and 2030 for the EU (from 82% to 92%), China (50% to 75%), and India (72% to 92%); while US dependence will marginally decline from 65% to 62%. In non-OECD countries, demand for natural gas is expected to grow

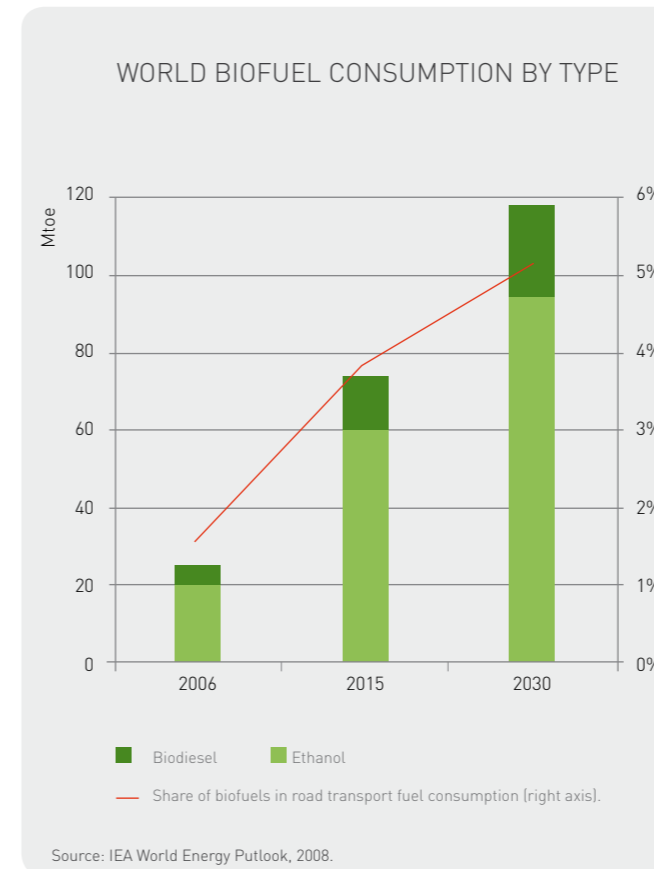


Figure 4: Biofuel Projections

from 1.451 bcm in 2006 to 2.607 bcm in 2030. However, key growth will come from China, accounting for 43% of the total projected increase between 2007 and 2030.

At the same time, future supply will be concentrated in resource-rich OPEC and other Middle Eastern countries. In contrast to non-OPEC countries, where oil production has already peaked or is about to peak, OPEC countries will be responsible for 52.9% of the world's output by 2030. Similarly, Middle Eastern countries are expected to supply 46% of the projected increase in world gas demand in the period 2006-2030. However, meeting the projected increase in demand depends largely on resource-rich countries making adequate and timely investments. Other important factors are conflict and

the international political climate. In the case of Iran, for example, sanctions imposed by the US and EU have impeded international investment in the Iranian energy sector. The civil conflict in Iraq has deterred oil companies from tapping its main reserves while turmoil in Libya has unnerved the oil market, causing Brent oil prices to hit \$111 per barrel. These economic and political factors are likely to cause more competition between biofuels and food.

Minerals and Energy

While global demand for minerals continues to increase, energy prices are expected to influence supply. More demand has been driven mainly by higher consumption levels in emerging economies, particularly China. For example, the United Nations Conference on Trade and Development (UNCTAD) estimates that between 2002 and 2006 China's share of global imports for aluminum ores and concentrates increased from 11.7% to 22.6%, and copper ores and concentrates from 13.5% to 18.7%. At the same time, many developing countries continue to rely heavily on imported minerals. According to an EU Commission communiqué, the EU is highly dependent on imports of metallic minerals and high-tech metals, such as cobalt, platinum, rare earths elements (REEs) and titanium. These minerals are necessary for the development of green technologies, such as platinum-based catalysts for hydrogen-fuel powered cars and lithium batteries for electric-hybrid cars. In the long run, prices for almost all minerals are projected to be higher than in the previous decades due to greater demand and insufficient investment in exploration and mining. Another factor impacting the supply of minerals is fossil fuels whose mining and extraction require significant amounts of energy. In the past, when metal minerals were short in supply, the availability of cheap and abundant fossil fuels, especially oil, made it feasible to extract minerals. However, higher energy prices may render the exploitation of some mineral deposits economically unviable.

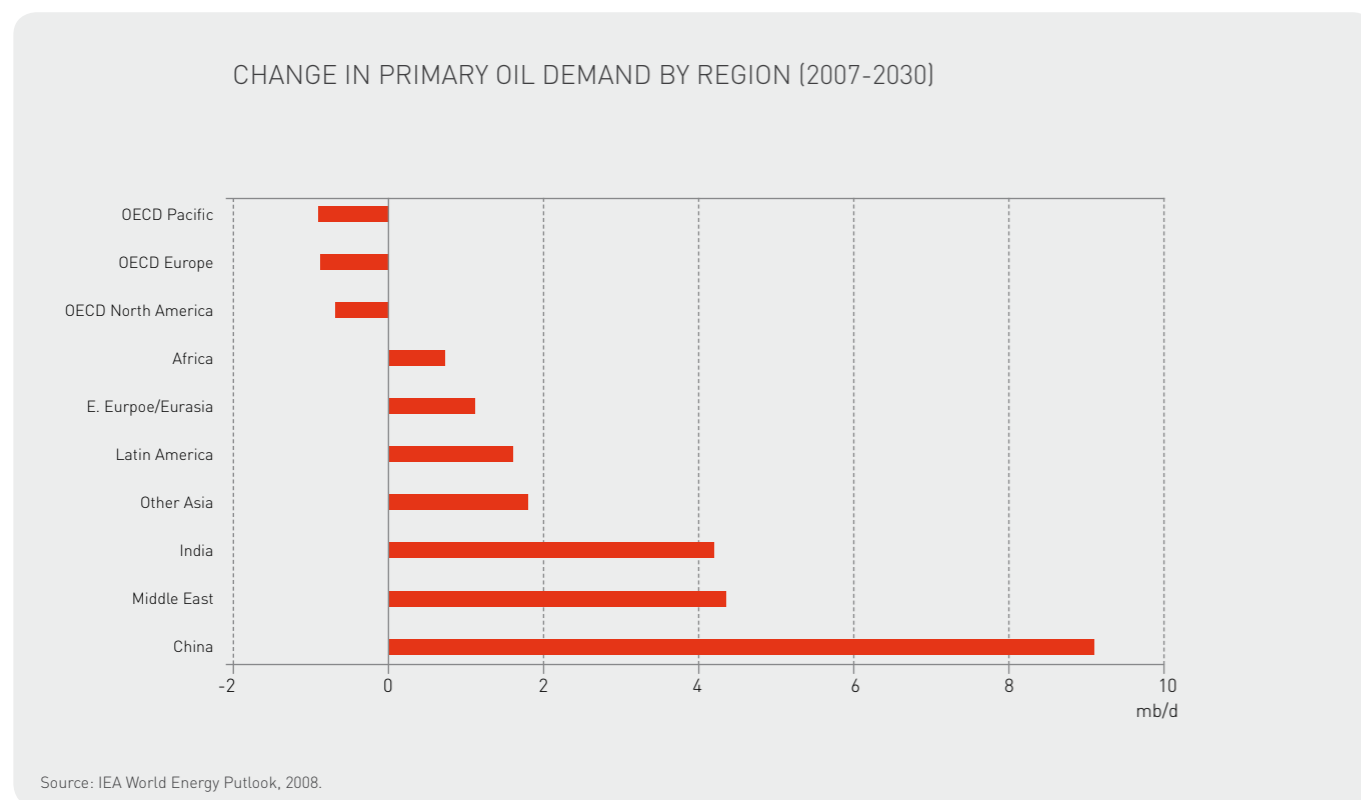


Figure 5: Trends in Primary Demand

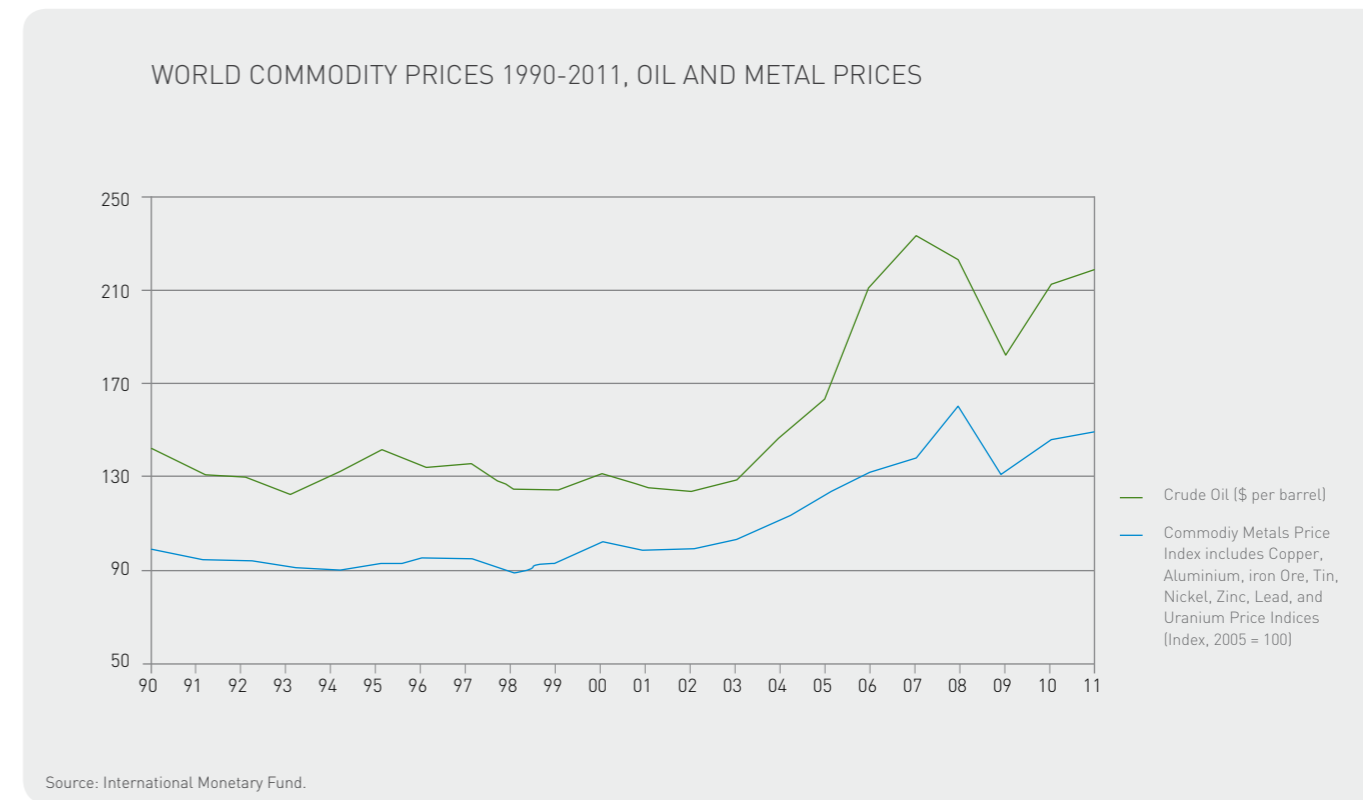


Figure 6: Commodity Prices

Scarcity and Human Security

Resource scarcity affects domestic and international security in various ways, such as aggravating poverty, causing migration, and triggering domestic turmoil and international conflict. For example, higher prices erode real income, pushing poor households into poverty. At the same time, water scarcity jeopardizes employment opportunities in the agricultural sector, undermining attempts to reduce poverty in many developing countries. Equally important is the effect that higher energy prices have on national output and the competitiveness of the commercial, industrial and transportations sectors.

Whether energy, food, water or minerals, the role of resources in instigating or prolonging conflict is well documented in the scholarly literature and supported by many cases. Take, for example, the issue of water

scarcity. A growing number of studies argue against the common conventional wisdom that water scarcity drives inter-state wars, linking instead water scarcity to intra-state conflicts.

Soaring food prices are known to trigger riots, such as those that have led in recent times to riots throughout the developing world: Bangladesh, Haiti, the Philippines, Indonesia Egypt, Tunisia, and Algeria. It is well known that energy and minerals have been used as instruments of economic pressure in international relations. Instances of such type of pressure take many forms, such as supply reductions, higher prices, or embargoes, the most recent being China's embargo on rare earth elements to Japan when tension escalated over Japan's detention of a Chinese fishing trawler captain in September 2010.

The New Approach

Resource scarcity constitutes a major challenge in the 21st century. Without adequate and secure access to the supply of food, water, energy and minerals, our wellbeing, economic prosperity and political stability will be at risk. In order to overcome the challenges of supply shortages and higher prices, the international community must work together closely and in new ways. First, a comprehensive approach must be endorsed. An effective response to resource scarcity not only tackles the scarcity problem of each resource but employs a comprehensive approach, which accounts for the interconnectedness between resources. Second, investment is necessary in technology and innovation. The development of new technology allows us to efficiently manage existing natural resources and to facilitate the development of cost-effective alternatives. New technologies have the potential to improve food and

water security and promise to offer viable alternative sources of energy. Third, the forces of free trade must be strengthened. For many countries imports are already the main source of supplies of food, minerals and energy. Thus, in order to mitigate price fluctuations and ensure access of supplies, it is necessary to reduce protectionist measures and subsidies. Finally, private sector involvement should be encouraged since its global reach, quick response to market changes and innovative capability can help to mitigate the effect of resource scarcity in multiple ways.



This publication is part of a series of WFF Issue Briefs that offer background information on themes to be addressed at the [World Foresight Forum](#). The Issue Briefs aim to inform and stimulate the debate on global challenges. The views and opinions expressed here are those of the authors and do not necessarily express the official views of the WFF or any of its speakers or sponsors.

World Foresight Forum is an initiative of _____



Authors: Islam Qasem, Teun van Dongen, Marjolein de Ridder

Copyright: 2011 World Foresight Forum (WFF). All rights reserved. No part of this Issue Brief may be reproduced and/or published in any form by print, photo print, microfilm or any other means without previous written permission from the WFF. All images are subject to the licenses of their respective owners.



World Foresight Forum (WFF)

Lange Voorhout 16
2514 EE The Hague
The Netherlands

T +31 70 363 6503
F +31 84 215 3165

info@worldforesightforum.org
www.worldforesightforum.org