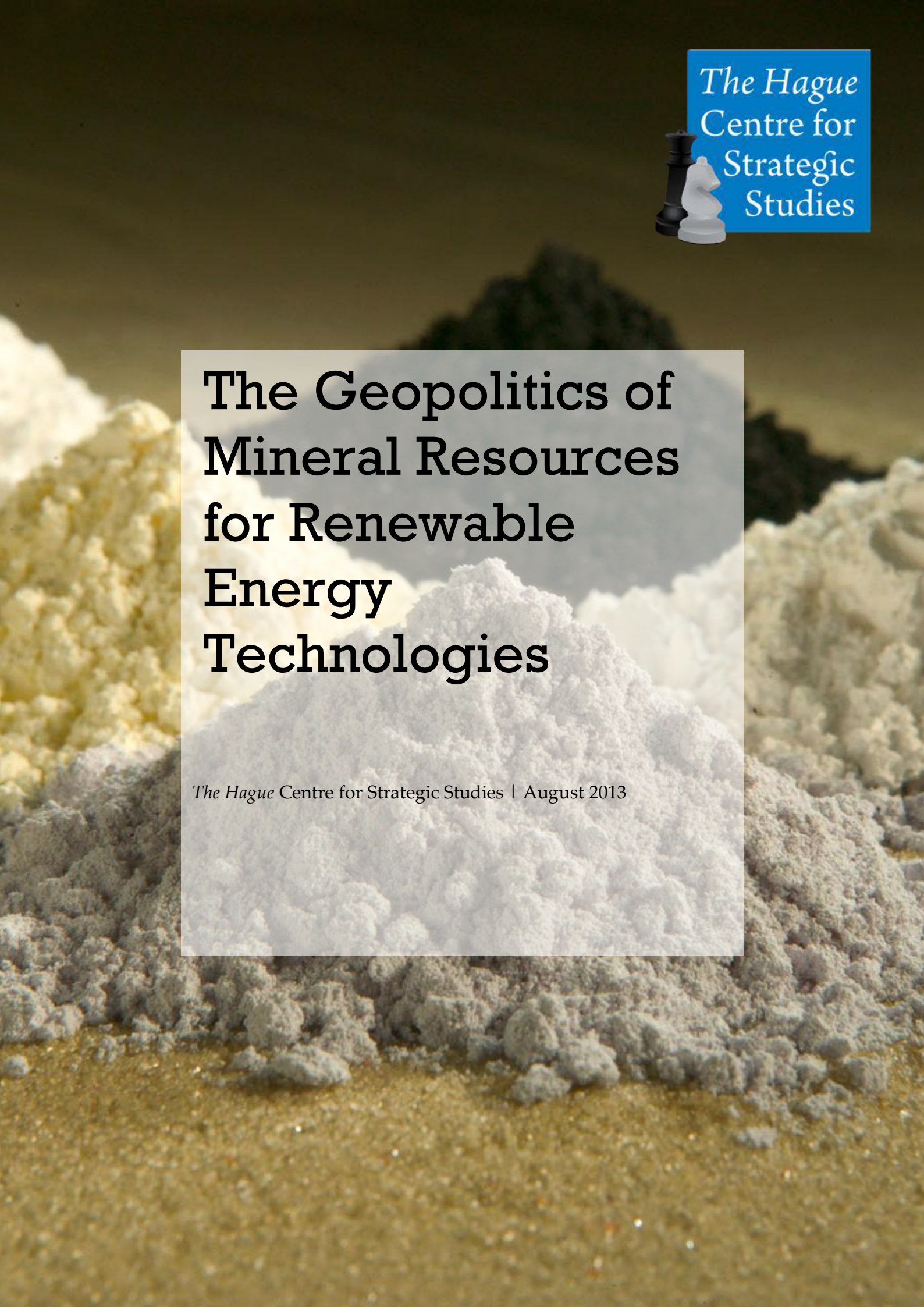

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The Geopolitics of Mineral Resources for Renewable Energy Technologies

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The Geopolitics of Mineral Resources for Renewable Energy Technologies[1]

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Key words

Minerals, resources, renewable energy, security of supply, geopolitics

Abstract

Which minerals are critical for the transition to renewable energy? How will future energy and mineral demand develop? And what will be the implications for international relations? This paper focuses on the geopolitics of minerals for renewable energy technologies. Motivated by concerns about climate change, depletion of fossil fuel reserves, economic competitiveness and innovation, governments around the world have set ambitious targets for renewable energy. This has increased the demand for certain minerals. At the same time, the international system is in transition to a multipolar world and state capitalist tendencies are becoming more prominent. This paper looks at the how both import dependent and mineral producing countries are responding to these developments and what the implications are for the balance of cooperation and conflict.

[1] This paper was first presented at the workshop "Geopolitics of Renewable Energy", organized by the Hanse-Wissenschaftskolleg - Institute for Advanced Study and Jacobs University Bremen, from 30 November to 2 December 2011, in Delmenhorst, Germany.

Introduction

Which minerals are critical for the transition to renewable energy? How will future energy and mineral demand develop? And what will be the implications for international relations? This paper focuses on the geopolitics of minerals for renewable energy technologies.

The geopolitics of minerals for renewable energy

Motivated by concerns about climate change, depletion of fossil fuel reserves, economic competitiveness and innovation, governments around the world have set ambitious targets for renewable energy. Renewable energy technologies, such as solar panels, wind turbines, and batteries of electric cars, are highly dependent on a number of minerals. One of the critical materials for renewable energy technologies are rare earth elements – a group of 17 minerals – have received a lot of attention in the media over the past years. Achieving renewable energy targets will be very difficult if not impossible without access to these elements.

There are several challenges to mineral supply security. Minerals are increasingly scarce due to growing demand and limited supply. Trends as population growth, economic growth, and changing consumption patterns are putting tremendous pressure on the demand for energy and mineral resources. Supply by contrast grows much slower due to a complex mix of factors. The imbalance between demand and supply has resulted in high prices and countries have to compete with each other over access to limited resources. These developments are a major concern for countries that rely on imports, as they are most vulnerable to supply disruptions. Supply disruption risks are high because the production of minerals is concentrated in a limited number of countries. China, for example, produces 97% of rare earth elements and is also a major producer of other minerals. This monopoly gives the country political leverage over other states.

Import dependent states have formulated policy responses aimed at securing a stable and affordable supply of minerals. Producing countries have also become more active in formulating mineral policy, as they want to benefit from high prices. This has resulted in a trend towards more government interference, mercantilism and protectionism. The increased role of governments and state owned enterprises is also related to the rise of state capitalism. Trends in mineral policy have both positive and negative implications for the balance of conflict and cooperation in international relations. The risk of international tension, however, is increased by the transition to a multipolar world, in which countries are focusing more on their national interests and international relations are becoming more uncertain and instable.

Structure

This paper proceeds in five parts. Chapter 1 looks which minerals are critical and the vulnerabilities they may create. Chapter 2 examines the drivers of the growing demand for renewable energy minerals. Chapter 3 discusses two systemic trends that will shape the geopolitics of minerals for renewable energy. Chapter 4 looks at the way countries are responding to the challenges of increased competition over mineral resources and the changes in the international system. Finally, chapter 5 concludes with an assessment of the implications for international relations.

1. Renewable energy technologies and minerals

Solar energy is among the fastest growing renewable energy technologies and is becoming ever more available in daily life. Wind energy is also rapidly gaining popularity as alternative source of electricity and will play a crucial role in the transition to affordable and clean energy. [2] Hybrid cars are becoming more and more popular and electric cars are considered the vehicles of the future. The transition to these types of renewable and clean energy technologies requires the use of advanced materials. The limited availability of these materials, however, poses a real challenges for the policy objectives that countries have set with regards to renewable energy.

Renewable energy targets

In the EU, the directive on renewable energy prescribes renewable energy for each of the member states, "such that the EU will reach a 20% share of energy from renewable sources by 2020 and a 10% share of renewable energy specifically in the transport sector." [3] In the US, president Obama has set a new target for electricity from low-carbon sources including renewable. In his State of the Union speech in January 2011, Obama indicated the ambition to become the first country to have a million electric vehicles on the road by 2015.[4] Many emerging economies are also in transition. China has set its renewable energy target at 15% by 2020, but expects to reach capacity as high as 20% by that time due to more investments in solar, wind and biomass energy resources. [5] Brazil already is the world's largest renewable energy market with 46% of the country's energy consumption and 85% of its power generation capacity coming from renewable sources, among which wind power becomes increasingly important. [6]

Key minerals

One way to produce energy from solar rays is to use thin-films of photovoltaic cells. To create these thin films, a range of minerals are used, including tellurium, tin, indium, hafnium, gallium. Other minerals used for solar technology are silver, cadmium and selenium.[7] The permanent magnets for the electric generators found in wind turbines require the rare earth elements dysprosium and neodymium. Nickel and molybdenum are also used for wind power technology. In the rechargeable batteries of electric vehicles one can find lithium and tungsten. Platinum is used in antipollution devices and vehicles. Cobalt and magnesium are used for bio-energy technology. The implementation of these technologies at a large scale, however, is problematic as many of these materials are relatively scarce.

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[2] International Energy Agency, *Clean energy progress report* (Paris, France: International Energy Agency, June 2011), 12, http://www.iea.org/papers/2011/CEM_Progress_Report.pdf.

[3] European Parliament and European Council, "Directive on renewable energy", April 23, 2009, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF.

[4] David Appleyard, "European and US Renewable Energy Targets," *Renewable Energy World International*, February 25, 2011, http://www.renewableenergyworld.com/rea/news/article/2011/02/european-us-renewable-energy-targets.

[5] Daue Chu, "China Considers Higher Renewable Energy Targets," *China Daily*, July 6, 2009, http://english.cri.cn/6826/2009/07/06/168s499130.htm.

[6] Arcadia Market Commentary, "Renewable Energy Development in Emerging Markets", August 2009, http://www.arcadia4u.com/commentaries/200908-Arcadia%20Market%20Commentary.pdf.

[7] Jaakko Kooroshy, Rem Korteweg, and Marjolein de Ridder, *Rare Earth Elements and Strategic Mineral Policy* (The Hague: The Hague Centre for Strategic Studies & TNO, 2010), http://static.hcss.nl/files/uploads/33.pdf.

Mineral scarcity

The public debate on mineral scarcity has been similar to the debate on peak oil.[8] The underlying assumption is that mineral reserves are finite. The intuitive conclusion from this so called 'static paradigm' is that the speed of extraction and consumption will determine the rate of depletion. Due to growing demand production will start struggling as soon as existing deposits have been exhausted and new ones become more difficult to find.

However, minerals are not scarce because there are not enough minerals to be found in the Earth's crust. In fact, rare earth deposits can be found in many places, such as China, the US, Canada, India, Vietnam, Kazakhstan and Sweden. [9] The total availability of minerals in the earth's crust in itself is irrelevant for the geopolitics of minerals for renewable energy. Mineral supply depends on whether known mineral deposits are profitable for extraction with current or future technology and under current or future market conditions.

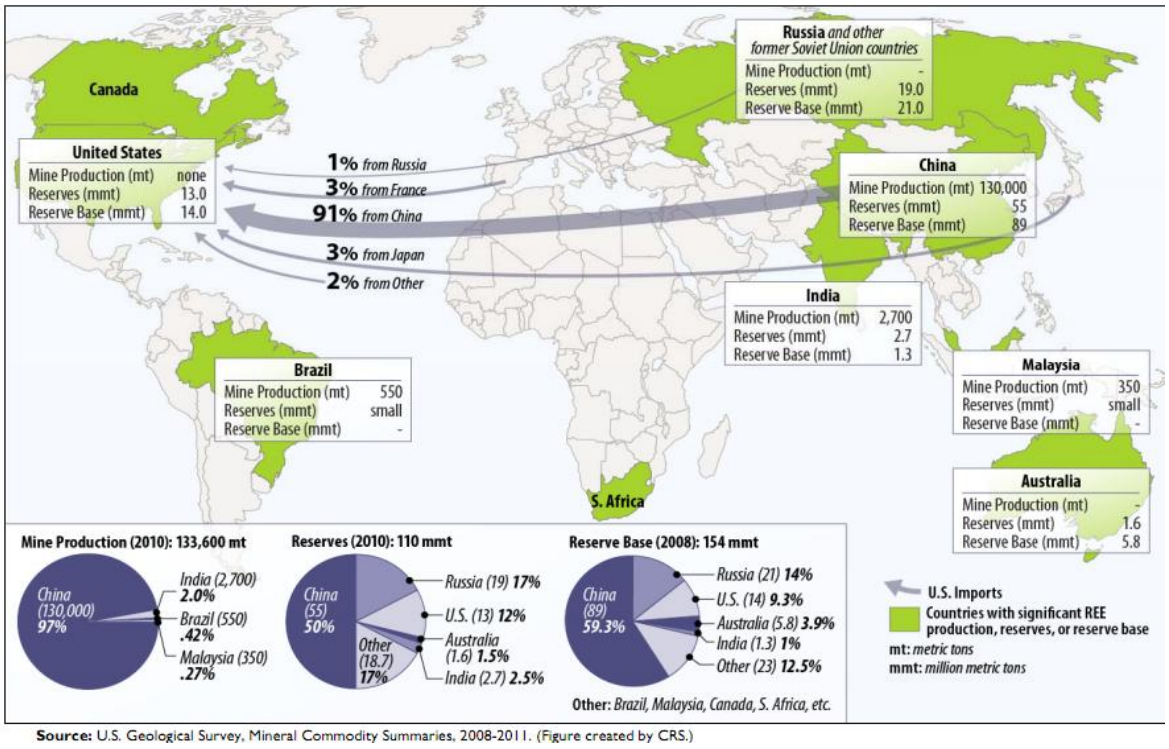

Figure 1 Rare Earth Elements: Production, reserves and US imports [10]

The supply of minerals is limited because under current market conditions only a small number of countries can mine minerals profitably. China is the largest producer of rare earth elements, accounting for up to 97% of global production. This kind of concentration of mineral production is the result of recent history. China has systematically built up a monopoly on rare earth elements during the past decades. There used to be rare earth production capacity in other countries but due to lower wages and less stringent environmental and health legislation in the Chinese mining sector, purchasing rare earth elements from China on the market became cheaper than maintaining domestic mining capacity. As a consequence, many countries, including the US, closed their domestic

[8] Ibid., 10–13.
[9] Reinhard Bütikofer, "Avoiding a scramble for resources," *UK Parliament Magazine*, May 2011.
[10] Marc Humphries, *Rare Earth Elements: The Global Supply Chain* (Congressional Research Service, July 28, 2010).

production of rare earth elements.[11] Besides rare earths, China is also the biggest or among the biggest producers of, tungsten, magnesium, molybdenum, vanadium, gallium, silver, tin, cadmium and indium.

Obstacles to supply security

Access to these minerals is key to achieve renewable energy targets. However, several factors are undermining the supply security of minerals. First, many countries are highly dependent on mineral imports. The degree of reliance depends on what services and products countries produce and on their economies' position along the supply chain. [12] Countries that produce renewable energy technologies sit closer to the refining stage in the supply chain than other countries. Japan, for example, is an important manufacturer of advanced electronics and is the world's largest consumer of rare earths for which it is almost fully reliant on China.

The EU also has only very limited mining capacity. There is a domestic mining capacity for some metals in Austria (tungsten), Finland, Greece (bauxite, nickel), Ireland (zinc, lead), Norway (titanium), Poland (copper, silver, lead), Portugal (tungsten), Spain (gold), and Sweden (gold, lead, iron ore). [13] For other metals, such as rare earths and platina group metals, it relies almost entirely on imports. Figure 2 shows the import dependency of the EU for several minerals. As a consequence, the EU has classified several raw materials as critical. In the report Critical Raw Materials for the EU (2010) by the Ad-hoc Working Group on Defining Critical Raw Materials and European Commission the following minerals are identified as critical at the EU level: antimony, indium, beryllium, magnesium, cobalt, niobium, fluorspar, platinum group metals, gallium, rare earths, germanium, tantalum, graphite and tungsten. [14] The criticality of these material was based on the economic importance of the material, its supply risk, the risk that environmental measures may restrain access to deposits or supply, and the potential for substitution.

Second, the concentrated production of minerals in a few states has raised fear among the high import dependent countries about supply risks. As renewable energy technologies become increasingly important for energy security and economic competitiveness, supply risks become an ever more important threat to national security.

Supply disruptions may be accidental or the result of political instability. Congo for example, is the biggest producer of cobalt (25,000 tons in 2009) and holds the world's vastest cobalt reserves (3,400,000 tons). [15] Cobalt is important to the generation of bioenergy.[16] China and Indonesia are the

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[11] Kooroshy, Korteweg, and de Ridder, *Rare Earth Elements and Strategic Mineral Policy*, 27.

[12] Graham Webster, "Rare Earth Elements, Asia's Energy Security, and Sino-Japanese Relations, An interview with Yufan Hao and Jane Nakano" (The National Bureau of Asian Research, May 12, 2011).

[13] "European mining industry by commodity," *mbendi.com*, n.d., http://www.mbendi.com/indy/ming/eu/p0005.htm.

[14] European Commission, "Critical raw materials for the EU: report of the Ad-hoc Working Group on defining critical raw materials", July 30, 2010, 6, http://ec.europa.eu/enterprise/policies/raw-materials/files/docs/report-b_en.pdf.

[15] U.S.G.S, "Mineral Commodity Summaries 2010", n.d., http://minerals.usgs.gov/minerals/pubs/mcs/2010/mcs2010.pdf.

[16] R.L Moss et al., *Critical Metals in Strategic Energy Technologies: assessing rare metals as supply-chain bottlenecks in low carbon energy technologies*, 2011.

main producers of tin and hold the largest reserves (1,700,000 and 800,000 tons respectively)[17] Silver is produced by Peru, Mexico and China. These countries score high on political risk indicators and consequently there is a high risk of supply disruption for these minerals. [18]

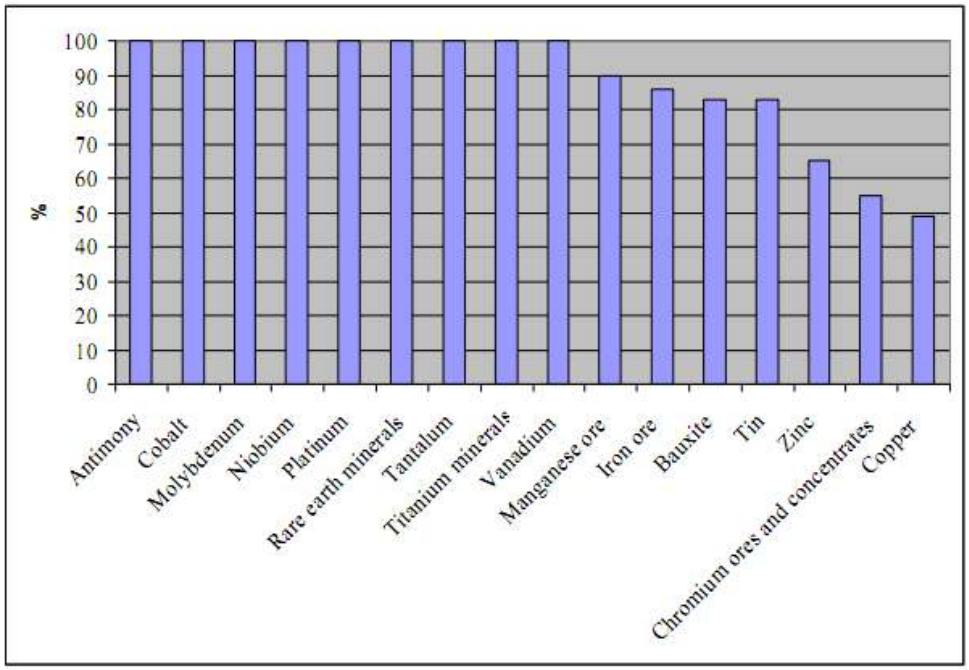

Figure 2 EU import dependency expressed as percentage of apparent consumption [19]

Supply disruptions, however, may also intentional. The transition to renewable energy gives states with large mineral reserves a source of leverage over other states. Export quotas or pricing measures can be used as a strategic political instrument. The temporary freeze of rare earth exports from China to Japan in an example of the strategic use of minerals in international relations today. In September 2010 a Japanese coast guard patrol boat and a Chinese trawler collided near the Senkaku island in the East China Sea. The Senkaku island are subject of a territorial dispute; both countries seek territorial integrity over the islands due to the nearby presence of oil reserves. In retaliation of the capture of the Chinese captain, China halted its rare earth exports to Japan until the diplomatic dispute was settled.

Renewable energy targets are threatened by mineral scarcity, high import dependence and the potential supply risks. The challenge of securing minerals for renewable energy becomes even more complicated in the context of the trends that will be discussed in the following chapters.

[17] U.S.G.S, "Mineral Commodity Summaries 2010."
[18] Moss et al., *Critical Metals in Strategic Energy Technologies: assessing rare metals as supply-chain bottlenecks in low carbon energy technologies*.
[19] European Commission, *Commission Staff Working Document accompanying the Communication from the Commission to the European Parliament and the Council - The Raw Materials Initiative - Meeting our Critical Needs for Growth and Jobs in Europe* (Brussels, 2008), http://ec.europa.eu/enterprise/sectors/metals-minerals/files/sec_2741_en.pdf.

2. Drivers of growing renewable energy and mineral demand

The geopolitics of minerals for renewable energy will be shaped by a growing demand for renewable energy and minerals. The growing demand for resources in emerging economies has already tightened global resources markets and resulted in an unprecedented commodities price boom. High oil and gas prices together with concerns about climate change, have triggered demand for renewable energy. Global trends, such as demographic shifts, economic growth, changing consumption patterns will put additional pressure on the demand for renewable energy and minerals in the coming years.

Climate change

A growing share of global energy demand will be met by renewable energy as environmental concerns become stronger and international actions to mitigate climate change become more concerted. These concerns are important drivers of the demand for low-carbon energy technologies. In recent years, renewable energy has seen 30% to 40% growth rates. [20] It is expected that the global use of renewable energy will triple in the coming decade and grow six-fold and four-fold in China and India respectively. Demand from Europe is expected to retain the lead.[21] Figure 3 shows how emerging technologies, such as batteries, thin layer photovoltaics, fuel cells, catalysts, permanent magnets, will affect the demand of several minerals.

Raw material	Production 2006 (t)	Demand from emerging technologies 2006 (t)	Demand from emerging technologies 2030 (t)	Indicator[1] 2006	Indicator[1] 2030
Gallium	152	28	603	0,18	3,97
Indium	581	234	1.911	0,40	3,29
Germanium	100	28	220	0,28	2,20
Neodymium (rare earth)	16.800	4.000	27.900	0,23	1,66
Platinum (PGM)	255	very small	345	0	1,35
Tantalum	1.384	551	1.410	0,40	1,02
Silver	19.051	5.342	15.823	0,28	0,83
Cobalt	62.279	12.820	26.860	0,21	0,43
Palladium (PGM)	267	23	77	0,09	0,29
Titanium	7.211.000 [2]	15.397	58.148	0,08	0,29
Copper	15.093.000	1.410.000	3.696.070	0,09	0,24

[1] The indicator measures the share of the demand resulting from driving emerging technologies in total today's demand of each raw material in 2006 and 2030;
[2] Ore concentrate

Figure 3 Mineral demand from emerging technologies [22]

Climate change mitigation will become an ever more urgent policy priority as a result of other systemic trends such as population growth, economic growth and changing consumption patterns. With a growing number of people on the planet – people that will live longer lives - the need for energy and other resources will grow. This will lead to more emissions from power generation,

[20] International Energy Agency, *Clean energy progress report*, 11.

[21] European Commission, "Press Release - Key Enabling Technologies to spur Europe's technological leadership", June 28, 2011, http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/796&format=HTML&aged=0&language=EN&guiLanguage=en.

[22] European Commission, "Critical raw materials for the EU: report of the Ad-hoc Working Group on defining critical raw materials," 7.

industry, and transport; and negatively affect climate change (unless drastic measures are adopted to curb their growth).

Population growth

In the coming decades, the size and composition of the world population will continue to change and increase the demand for energy and natural resources. First, although the rate of population growth has been slowing down, the world population in absolute numbers will grow rapidly due to declining mortality rates in combination with a stable global fertility rate. According to the UN Population Fund, the world population will surpass 9 billion people by 2050 and hit 10,1 billion by 2100.[23] The majority of growth will take place in developing countries, with a high proportion in cities.[24] Second, age structures are changing worldwide and the global median age is rising. Due to improved sanitation, healthcare and healthier and wealthier lifestyles, life expectancy is climbing in both the developed and developing world.[25] Third, urbanization is expected to continue and the number of mega-cities with more than 10 million habitants will increase.[26] Urban development will increase the development of infrastructure for sanitation, water, transport and other public services for which energy and mineral resources will be needed.

Economic development

Economic development will also continue to be major driver of the global demand for resources. For a long time, high levels of energy and mineral demand were primarily associated with the consumption and production patterns and lifestyles in the developed world. Today, however, it is the accelerated economic growth of non-Western economies that is driving the growing demand for energy and minerals. While the energy use in high-income countries increased by 20% between 1990-2006, total energy use increased 40% in non-OECD countries. [27] Despite the negative effects of the economic crisis, the World Bank predicts that global GDP growth will continue to be strong in the coming years with an average of 3.6% in 2013. In developing economies this percentage is even projected to be as high as 6.3%.[28] If this economic growth patterns persist in the coming decade, low and middle-income countries will be at the origin of most of the increase in global demand for energy and mineral resources. Most growth will be driven by China, India and other emerging economies, and the Middle East and Caspian Sea regions.[29]

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[23] UN Population Fund, "Population Trends", n.d., http://www.unfpa.org/pds/trends.htm.

[24] United Nations, Division for Sustainable Development – Department of Economic and Social Affairs., *Trends in Sustainable Development: Towards Sustainable Consumption and Production* (New York, 2010), 11, http://www.un.org/esa/dsd/resources/res_pdfs/publications/trends/trends_sustainable_consumption_production/Trends_in_sustainable_consumption_and_production.pdf.

[25] Stephan de Spiegeleire et al., *Strong in the 21st Century* (The Hague: The Hague Centre for Strategic Studies, 2010), 18–21.

[26] Population Reference Bureau, "Human Population: Urbanization", n.d., http://www.prb.org/Educators/TeachersGuides/HumanPopulation/Urbanization.aspx.

[27] United Nations, Division for Sustainable Development – Department of Economic and Social Affairs., *Trends in Sustainable Development: Towards Sustainable Consumption and Production*, 1.

[28] World Bank, "Global economic prospects 2011", June 2011, http://siteresources.worldbank.org/INTGEP/Resources/335315-1307471336123/7983902-1307479336019/Full-Report.pdf.

[29] European Commission, *Commission staff working paper - Key Facts and Figures on the external dimension of the EU energy policy* (Brussels: European Commission, September 7, 2011), 2, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SEC:2011:1022:FIN:EN:PDF.

Prosperity and changing consumption patterns

Prosperity levels in emerging economies and the developing world will continue to rise with economic growth and this will change lifestyles and consumption patterns. The increased demand for luxury goods and services, such as cars, cell phones, and traveling, will also augment the demand for energy and minerals. The rapidly growing middle class of countries like China, where the middle class is expected to increase by four times between 2004-2025, is also moving up the food chain and wants to eat more meat, eggs and dairy products. [30] The production of this type of products is resource intensive: food and drink have the highest ecological impact per dollar spent, followed by household equipment and transport.[31] Due to population growth, the number of people with a resource intensive lifestyle will increase. [32] Globally, the middle class is expected to triple by 2030. In that scenario, almost 80% of the world population will be part of the middle-income class.[33]

Price developments

The growing demand for resources has led to an unprecedented commodities price boom. According to the World Bank, the commodity price spike between 2005 and 2007 was the highest and longest since 1900.[34] The financial crisis did only temporarily bring down prices as growth in the emerging economies picked up sooner than expected. As long as this economic growth and other trends underpinning demand persist, commodity prices will continue to remain high.

Supply side factors also contribute to high prices. The mineral supply side has generally struggled to keep pace with this rapid expansion of demand due to insufficient investment and other political, financial, geological and technical barriers to the exploitation of new mineral reserves. The fear that high prices will bring about investment in extra production capacity that will eventually bring down prices to a level that would make some investments economically unviable, is also a hampering factor.

Some experts believe that increased speculation of non-commercial actors on commodities futures markets also has increased commodity prices and made them more volatile. Financial firms are increasingly investing in commodities through futures contracts and other financial instruments. Academic research, however, is not conclusive on the relationship between price volatility and the activity of financial institutions and non-commercial actors on commodities markets.[35]

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[30] Lester R. Brown, "The New Geopolitics of Food," *Foreign Policy*, no. May/June (2011), http://www.foreignpolicy.com/articles/2011/04/25/the_new_geopolitics_of_food?page=full.

[31] World Wide Fund, *One Planet Business: Creating Value Within Planetary Limits* (World Wide Fund, 2007), http://assets.wwf.org.uk/downloads/one_planet_business_first_report.pdf.

[32] Klaus Hubacek, Dabo Guan, and Anamika Barua, "Changing lifestyles and consumption patterns in developing countries: A scenario analysis for China and India," *Futures* 39, no. 9 (2007): 1084 – 1096.

[33] World Business Council for Sustainable Development, *Sustainable Consumption: Facts and Trends* (World Business Council for Sustainable Development, 2008), http://www.wbcsd.org/DocRoot/l9Xwhv7X5V8cDIHbHC3G/WBCSD_Sustainable_Consumption_web.pdf.

[34] World Bank, *Global Economic Prospects 2009 - Commodities at the crossroads* (Washington, DC, USA: The International Bank for Reconstruction and Development / The World Bank, 2009), http://siteresources.worldbank.org/INTGEP2009/Resources/10363_WebPDF-w47.pdf.

[35] Rem Korteweg, Marjolein de Ridder, et al, *Op weg naar een Grondstoffenstrategie. Quick scan ten behoeve van de Grondstoffennotitie* (The Hague: The Hague Centre for Strategic Studies, 2011), http://static.hcss.nl/files/uploads/780.pdf.

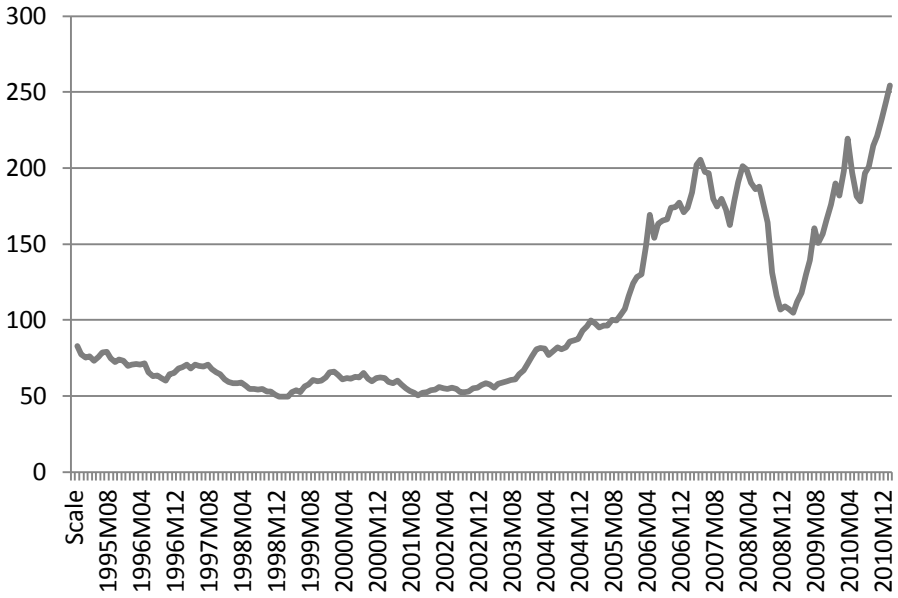

Figure 4 IMF Monthly Nominal Base Metal Price Index (100 - 2005 average)

High prices and high price volatility have set in motion self-correcting mechanisms. In response to high fossil fuel prices demand for non-conventional and renewable energy has increased. High mineral prices have encouraged the exploitation of new sources, material substitution and recycling. These market correcting mechanisms are increasingly complemented by strategic interference of governments that are formulating policy responses to deal with changes with the trends described above but also with broader changes in the international system.

3. The emerging international system

The international context in which countries have to secure minerals for renewable energy is rapidly changing. This chapter identifies two major trends in the international system that will shape the geopolitics of minerals for renewable energy. First, it looks at the shift towards a multipolar world, then it examines the transition from a market capitalist economic system to a system in which state capitalist tendencies are more prominent.

Transition to a multipolar world

The international system is in transition to a multipolar world. This means that the world is no longer dominated by one strong power - which used to be the US- but that instead multiple centers of power are emerging. The relative power of the West is declining and the center of gravity of the international system is shifting eastwards. Boosted by economic growth, the BRIC countries[36] (Brazil, Russia, India and China), but also other players, such as Turkey, are increasingly challenging the Western dominated international order.

[36] The term BRIC was coined in Jim O'Neill, *Building Better Global Economic BRICs*, Global Economics Paper (Goldman, Sachs & Co, November 30, 2001), http://www2.goldmansachs.com/our-thinking/brics/brics-reports-pdfs/build-better-brics.pdf.

The economic crisis is accelerating the transition to a multipolar world. Western States are faced with declining GDP growth, soaring government debts, depreciating currencies and depleted national reserves. The US federal debt crisis has weakened its international position and has made the country increasingly dependent on foreign, mainly Chinese, creditors. The US will eventually have to reduce its federal budget deficit, which inevitably will have its effect on military expenditure and its relative power. In Europe, the euro-crisis is threatening the very existence of the monetary union. As European leaders struggle to solve the crisis, the EU's internal economic and political fragmentation becomes more and more visible, which will further undermines its geopolitical muscle. [37] Emerging economies on the other hand, have been less profoundly affected and have recovered more rapidly from the crisis than the West. China is likely to continue its economic growth and will eventually transition from an emerging economy to an 'emerged economy'.[38]

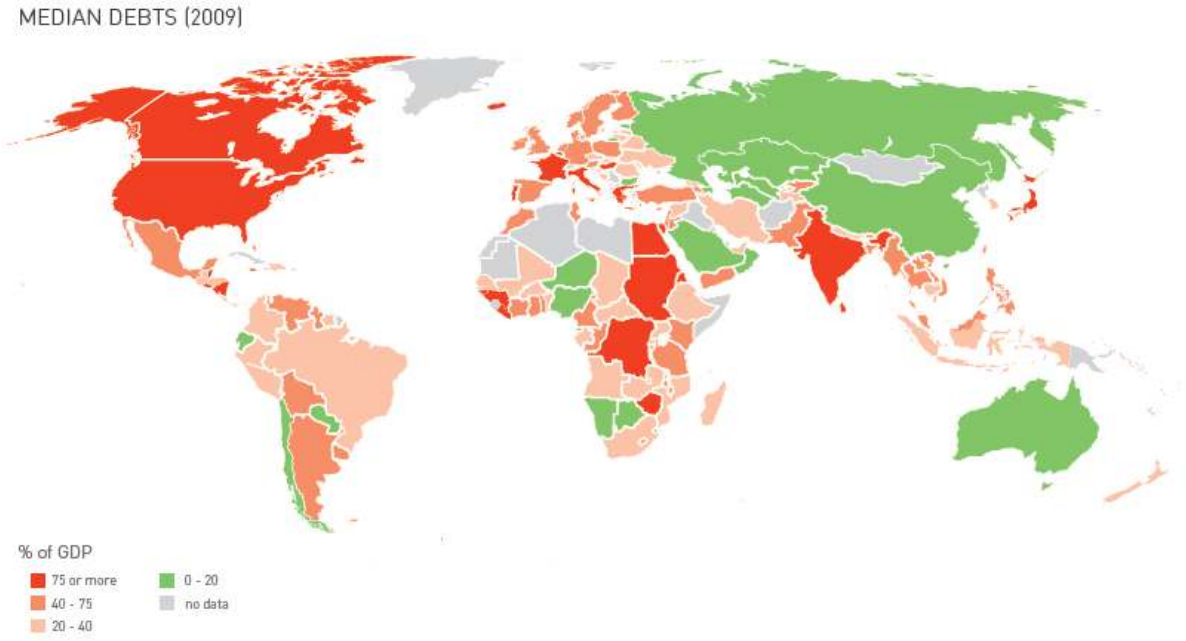

Figure 5 Median debts (2009) [39]

In a multipolar world, countries will increasingly be turned inwards, focusing on their narrow national interests rather than on public good. This means the role of international institutions, such as the United Nations or the World Trade Organization (WTO), will be reduced and that it will be harder to advance multilateral agendas that benefit the international system as a whole.[40] Multipolarity increases uncertainty, instability and complexity in international relations and consequently augments the chances of international friction. Such a political context will increase the likelihood of

[37] Islam Qasem, Teun Van Dongen, and Marjolein de Ridder, *The Global Financial Crisis and the End of the Free Market*, Issue Brief 03 (The Hague: World Foresight Forum, 2011).

[38] Matthew Hulbert, "Power shifts: Emerging markets emerged, geopolitics fractured," ed. Center for Security Studies, EHT Zurich, *Strategic Trends 2011* (March 6, 2011): 11-33.

[39] Qasem, Van Dongen, and de Ridder, *The Global Financial Crisis and the End of the Free Market*.

[40] Aurélie Basha i Novosejt et al., *Sustainability in a Multipolar World* (The Hague: The Hague Centre for Strategic Studies & TNO, 2010), http://static.hcss.nl/files/uploads/465.pdf.

mineral supply disruptions due to protectionist policies or because countries use resources as strategic instruments.[41] Multipolarity will be one of the biggest drivers of the geopolitics of minerals for renewable energy.

Rise of state capitalism

The international system is also in transition to a system in which state-capitalist tendencies are more prominent. [42] Again, the economic crisis has accelerated this transition, as the debt crises in the US and EU have raised doubt about the economic and political primacy of the neo-liberal market democracy. To deal with the crisis, leaders around the world have increased state control over the economy and have reduced, if not reversed, measures of deregularization, privatization and trade and financial liberalization. In the mineral sector, this is resulting in increased access restrictions, trade barriers, export quotas, and other manifestations of growing protectionism and resource nationalism. Government intervention in the resource sector has been widespread in non-democratic states for decades. The economic crisis, however, appears to have broken the taboo against economic government interference in liberal market democracies.[43]

Resource nationalism refers to a situation in which control over natural resources shifts from foreign to domestic state-owned companies. It also means governments align their natural resource policies more explicitly with the national interest. Resource nationalism will become an important feature of the geopolitics of minerals for renewable energy, as state capitalist approaches are gaining popularity in emerging and developing economies.

The rise of state capitalist approaches can be explained by the failure of the so called Washington Consensus in large parts of the developing world. The Washington Consensus was a neo-liberal program for economic development prescribed to developing countries by the international financial institutions in Washington during the late 1980s and 1990s. China's economic successes and the contrasting financial troubles in Western economies have brought the Chinese state-capitalist model to the fore as an attractive alternative approach to economic development.[44] The Chinese model is based on state-led economic growth without political liberalization. The authoritarian regime can do business with resource rich developing countries much quicker than liberal democracies, which often lack long term strategic vision and decisiveness, or international organizations.[45] The words of the Senegalese president Abdoulaye Wade illustrate this point:

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[41] Korteweg, de Ridder, et al, *Op weg naar een Grondstoffenstrategie. Quick scan ten behoeve van de Grondstoffennotitie*, 22–23.

[42] Roland Dannreuther, *Understanding conflict and cooperation in access to oil, gas and minerals*, European Policy Brief (Polinares, January 2011), http://ec.europa.eu/research/social-sciences/pdf/policy-briefs-polinares_en.pdf.

[43] Qasem, Van Dongen, and de Ridder, *The Global Financial Crisis and the End of the Free Market*.

[44] Islam Qasem, Teun Van Dongen, and Marjolein de Ridder, *The Beijing Consensus: An alternative approach to development*, Issue Brief 02 (The Hague: World Foresight Forum, 2011).

[45] Islam Qasem, Teun Van Dongen, and Marjolein de Ridder, *Liberal Democracy: Up to the challenges of the 21st century?*, Issue Brief 05 (The Hague: World Foresight Forum, 2011).

"If I wanted to do five kilometers of road with the World Bank, or one of the international financial institutions, it takes five years. One year of discussions. One year of back and forth. One year of I don't know what. With the Chinese it is a few days and I say yes or no, they send a team and we sign."[46]

China's foreign policy and economic diplomacy are characterized by a pragmatic approach. Due to its adherence to the principle of non-interference and its 'no (political) strings attached' development assistance policy, China is considered an attractive economic and political partner for many resource rich developing countries.[47] In return for beneficial terms of trade, aid and investment, China's state owned enterprises have gained access to large mineral reserves in the developing world, particularly in Africa.

The incorporation of resource rich developing countries into China's sphere of influence may reinforce the rise of state capitalism. The departure from the dominance of market capitalism in the international system has important geopolitical implications. Both the rise of state capitalism and the transition to a multipolar world will put increased pressure on the rules and values that are in place to safeguard the free trade of mineral resources. It is encouraging governments to also assess their policies through a strategic lens.

4. Policy trends

Renewable energy targets, intensified resource competition, high mineral prices and price volatility have motivated governments to adopt a more proactive attitude. This is reflected in the policy trend to consider minerals increasingly as strategic issue, both in producing countries and import dependent countries. As a consequence, the supply and demand of natural resources are no longer solely an economic matter regulated by the market and international free trade; they are increasingly shaped by geopolitical developments and government interference. Trends in mineral policy are in part a response to the international developments described above, but will in turn also enhance the negative effects of multipolarity on international relations.[48]

Import dependent countries: securitization of mineral policy

Countries with limited to no mineral resource endowment are most vulnerable to the effects of high mineral prices and supply disruptions. As a consequence, mineral policy in import dependent countries will have a strong security dimension. High prices and supply disruption are a threat to economic security, as they may reduce a country's economic and innovative competitiveness and negatively affect national employment and prosperity. In some countries, economic security is also important for social and political security. In China for example, securing resources for economic growth is key to avoid instability from domestic opposition to the authoritarian regime. Some metals

[46] Comment by Senegal's President Abdoulaye Wade on the EU-Africa summit in Lisbon, 8-9 December, 2007. William Wallis and Andrew Bounds, "Spectre of colonialism vies with Spirit of Lisbon," *Financial Times*, December 9, 2007, http://www.ft.com/intl/cms/s/0/cf2cf164-a683-11dc-b1f5-0000779fd2ac.html#axzz1eFMbGQbf.

[47] Marjolein de Ridder, "De opmars van China in Geopolitiek Perspectief," *Marineblad Koninklijke Vereniging van Marineofficieren*, 2011.

[48] The sections in this chapter are an adaptation of the conceptual framework for understanding natural resource policy in a multipolar world that was originally developed in Korteweg, de Ridder, et al, *Op weg naar een Grondstoffenstrategie. Quick scan ten behoeve van de Grondstoffennotitie*, 35–57.

are also of strategic importance for military security, as they are used in high-tech defense technologies. As a consequence, import dependent countries show a tendency to securitize their mineral policy.

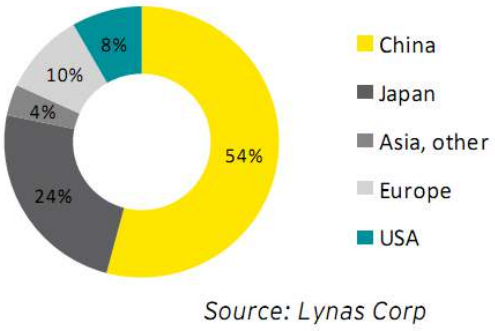

Figure 6 Demand forecast by region (2010) [49]

The securitization trend is reflected in the three categories of measures that characterize import dependent countries' mineral policy. First, import dependent countries employ policy instruments aimed at securing a stable and affordable supply from abroad. They increasingly seek to conclude strategic bilateral agreements with producing countries or to establish joint ventures in resource rich countries. Japan, for example, forged a strategic partnership with Mongolia to gain access to rare earths and to diversify its supplies away from China. In November 2010, this led to a memorandum of understanding between the Japanese high-tech manufacturer Toshiba with MNFCC LLC, which is charged with the implementation of mineral resources policy in Mongolia.[50]

Diplomacy is a key instrument for making such bilateral agreements. In 2011 the European commission published a new strategy on raw materials that stresses the importance of resource diplomacy. In the strategy the EU indicates in order to promote a fair and sustainable supply of raw materials from global markets, it will "actively pursue a "raw materials diplomacy" with a view to securing access to raw materials, in particular the critical ones, through strategic partnerships and policy dialogues."[51]

[49] Ernst and Young, "Mining and metals Rare Earth Elements: opportunities and challenges", November 2010, 2, http://www.ey.com/Publication/vwLUAssets/Rare_earth_elements/$FILE/Rare%20Earths%20-%20Opportunities%20and%20challenges.pdf.

[50] Toshiba, "Toshiba Signs Memorandum of Understanding on Cooperation in Development of Mineral Resources and Social Infrastructure with Mongolia's MNFCC," *www.toshiba.co.jp*, November 26, 2010, http://www.toshiba.co.jp/about/press/2010_11/pr2601.htm.

[51] European Commission, *Tackling the challenges in commodity markets and on raw materials* (Brussels: European Centre for International Political Economy, February 2, 2011), 14, http://ec.europa.eu/enterprise/policies/raw-materials/files/docs/communication_en.pdf.

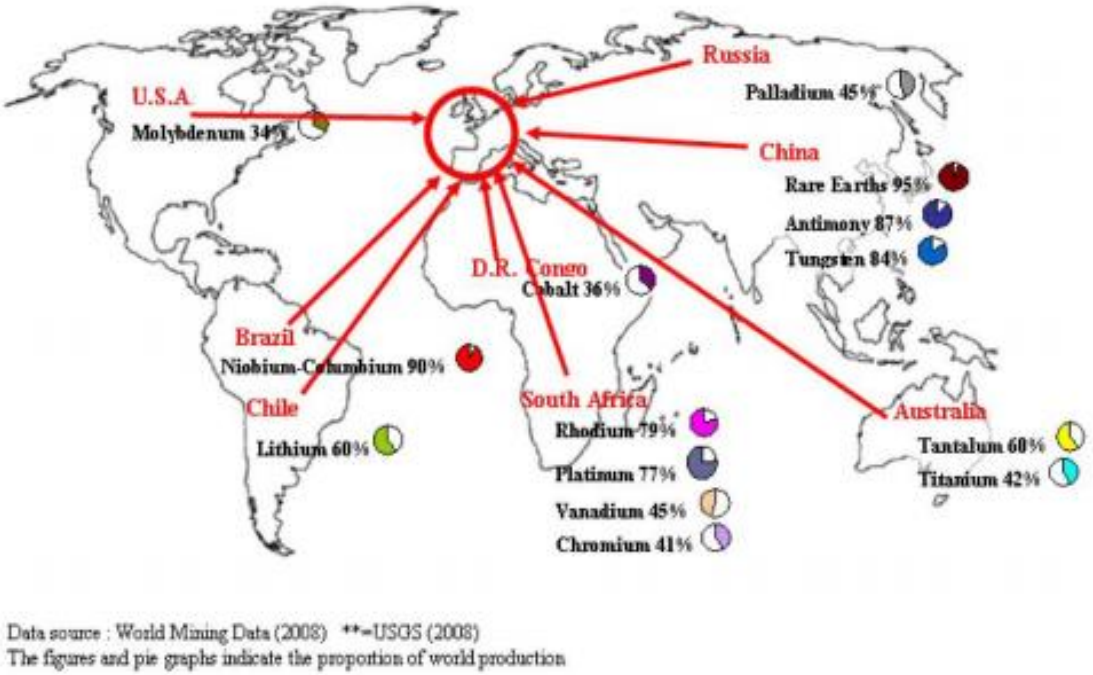

Figure 7 Important mineral suppliers for the EU [52]

Another way of gaining access to resources abroad is upstream integration in the value chain. This means securing minerals by becoming active in stages in the production chain that are closer to the mineral extraction stage. The German government is offering loans to German companies to create incentives for vertical integration and involvement in exploration projects abroad. [53]

Proactive acquisition of mineral resources abroad can also manifest itself as development assistance. The EU Green Paper on EU development policy outlines gaining access to energy and raw materials as one the priorities of EU development efforts.[54] The German raw material strategy explicitly mentions development cooperation as one of the instruments to enhance resource security.[55] Japan's has the most comprehensive strategy, integrating policies in the areas of resources, energy and industry with foreign policy and development assistance. The growth strategy of the Ministry of Economy, Technology and Industry stresses Japan's ambition to build "stronger relationships with resources-rich countries through cooperation in industrial development, human resources

[52] European Commission, *Commission Staff Working Document accompanying the Communication from the Commission to the European Parliament and the Council - The Raw Materials Initiative - Meeting our Critical Needs for Growth and Jobs in Europe*.

[53] German Federal Ministry of Economics and Technology (BMWI), *The German Government's raw materials strategy- Safeguarding a sustainable supply of non-energy mineral resources for Germany* (Berlin: BMWI, October 2010), http://www.bmwi.de/English/Redaktion/Pdf/raw-materials-strategy,property=pdf,bereich=bmwi,sprache=en,rwb=true.pdf.

[54] European Commission, *EU development policy in support of inclusive growth and sustainable development - Increasing the impact of EU development policy*, Green Paper (Brussels: European Commission, November 10, 2010).

[55] German Federal Ministry of Economics and Technology (BMWI), *The German Government's raw materials strategy- Safeguarding a sustainable supply of non-energy mineral resources for Germany*, 22–23.

development, improvement of regional infrastructure, and the like, which meet diverse needs in such countries."[56] In 2010, Japan gained access to Bolivia's lithium reserves in exchange for financial support and the construction of solar panels, energy plants and hospitals.[57]

Second, import dependent countries take policy measures to reduce their import dependency. This results in policies that that aim to reduce domestic consumption and to promote reuse and recycling of materials, the exploitation of alternative domestic sources and the development of substitutes. Import dependence can also be reduced by stockpiling strategic materials, like in South Korea where a national stockpile was established in 2005.[58] The US also used to have an extended strategic defense stockpile. Due to the believed negative effects of stockpiling on the mineral market and on mineral prices, the US is currently transforming its traditional defense stockpiling program into a broader and more flexible Strategic Materials Security Program.[59]

Third, import dependent countries may use military capabilities to secure mineral resources. This is the most extreme manifestation of the securitization of mineral policy. The increased military presence in the resource rich Arctic region and the South China Sea illustrate this policy trend. The latest NATO Strategic Concept also describes disruptions of the international trade in energy and other resources as a threat to the security of the members of the alliance. [60]

Politicization of mineral policy in producing countries

Developments on the mineral market and in the international system have induced producing countries to view their mineral endowment increasingly as an asset to achieve their economic and political objectives, both domestically and internationally. This politicization has resulted in a resource nationalism in the mineral sector that is similar to the better know resource nationalism in the oil and gas sectors.[61] This resource nationalism has strong protectionist and mercantilist features.

Governments in producing countries are increasingly limiting the access to the domestic resource sector to foreign companies. This is reflected in measures, such as increased license fees, which make it more difficult for other states to invest and gain access to upstream resources in producing countries. In Canada for example, the government ruled against the take-over of the Canadian

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[56] See action 41 of *100 Actions to Launch Japan's New Growth Strategy* (Japanese Ministry of Economy, Trade and Industry, August 2010), 14, http://www.meti.go.jp/english/aboutmeti/policy/2011policies.pdf.

[57] Nick Chambers, "Japan Securing Battery Raw Materials with Economic Aid to Bolivia," *gas2.org*, April 5, 2010, http://gas2.org/2010/04/05/japan-securing-battery-raw-materials-with-economic-aid-to-bolivia/.

[58] Bomi Lim, "South Korea to Cut China Rare-Earth Dependency as Imports Drop," *Bloomberg.com*, October 22, 2010, http://www.bloomberg.com/news/2010-10-22/south-korea-to-cut-dependency-on-china-rare-earth-supplies-as-imports-drop.html.

[59] Undersecretary of Defense for Acquisition, *Technology and Logistics Reconfiguration of the National Defense Stockpile - Report to Congress* (US Department of Defense, April 2010).

[60] *NATO, Active Engagement, Modern Defence. Strategic Concept for the Defense and Security pf the Members of the North Atlantic Treaty Organization.*, November 19, 2010, http://www.nato.int/lisbon2010/strategic-concept-2010-eng.pdf.

[61] Korteweg, de Ridder, et al, *Op weg naar een Grondstoffenstrategie. Quick scan ten behoeve van de Grondstoffennotitie*, 49.

potash producing company Potash of Saskatchewan by mining multinational BHP Billiton on the ground that the take-over was not serving Canada's interest.[62]

Increased taxation on extraction revenues is a means of producing countries to increase the state's revenue. In Australia the government announced the introduction of a super profit tax on profits generated by companies in the extraction industry. The government justified the tax measure by stating that the from the country's soil should not only benefit international mining companies but also Australia's population.[63] In February 2011, South African president Zuma launched a state-owned mining company, called the African Exploration Mining and Finance Corporation (AEMFC), for a similar reason. South Africa is currently debating on whether or not to fully nationalize its mining sector.[64] State owned companies allow producing countries to maximize the benefits from high mineral prices.

Resource nationalism can also result in export quotas. Especially China's export restrictions on rare earths have received a lot of media attention. This is related to the way China used its rare earth monopoly to settle its diplomatic incident with Japan, as discussed above.

To sum up, there is trend towards more government interference in both import dependent and producing countries. It is likely that the trends towards securitization and politicization of mineral policies will persist as the demand for renewable energy technologies grows. It has to be noted that the degree of government control over the resources sector varies. In state capitalist systems government control is stronger than in countries that have a market capitalist tradition. States also take different approaches when formulating resources policies. For example, in France resource policy is formulated more top down than in Germany, where the governments works closely with the industry.[65] Nonetheless, the general trend towards more government interference has important implications for international relations, which will be discussed in the next chapter.

5. Implications for international relations

The growing demand for minerals for renewable energy has resulted in increased government interference on global mineral markets and strategic mineral policies. This has both positive and negative consequences for the availability of minerals and international relations. The importance of minerals to the transition to renewable energy changes the relative power position of states in the international system.

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[62] "Canada blocks BHP Potash takeover," *BBC*, November 3, 2010, sec. Business, http://www.bbc.co.uk/news/world-us-canada-11680181.

[63] Peter Smith, "Uproar grows over Australia's super-profits tax," *Financial Times* (Sydney, May 12, 2010), http://www.ft.com/intl/cms/s/0/a766a21c-5d5e-11df-8373-00144feab49a.html#axzz1eFMbGQbf.

[64] "Zuma launches new mining company," *BBC*, February 27, 2011, sec. Business, http://www.bbc.co.uk/news/business-12591324.

[65] Marjolein de Ridder and Rem Korteweg, *Topsectoren in Perspectief: Grondstoffen en het Topsectorenbeleid* (The Hague: The Hague Centre for Strategic Studies, September 19, 2011), http://static.hcss.nl/files/uploads/811.pdf.

Increased state intervention

States will be the main actors determining the geopolitics of minerals for renewable energy. Next to powerful multinational mining companies, state owned enterprises will rise as ever more important actors in the mineral industry. State intervention on mineral markets will continue to increase with the rise of state capitalist approaches. Developments on the mineral market will also encourage state intervention, as the combination of structurally high and highly volatile mineral prices creates political and economic risks as well as opportunities for governments in producing and import dependent countries. In contrast with the uncertainty created by high price volatility and the transition to a multipolar world stands the certainty that the demand for renewable energy will continue to increase, although the rate of growth may be volatile and dependent of government policies. Growing concerns about climate change, energy security and resource competition are challenges all countries must deal with. Governments are responding to these challenges with policies of securitization or politicization. These state interventionist policy trends may have both positive and negative implications for the supply security of minerals for renewable energy and international relations.[66]

Prospects for cooperation

Seen through the political-economic lens of producing countries, high mineral prices are an opportunity to reap profits. This will trigger direct investment in the mining sector by the state or policies aimed at encouraging investments by the private sector. In import dependent countries, high mineral prices and the supply risks associated with import dependency will be viewed through a national security lens. This will lead to policies aimed at enhancing resource efficiency, reducing consumption, promoting recycling and reuse, and the development of substitutes. The policy measures of both producing and import dependent countries will have positive effect on the availability of minerals on the market. If the market conditions loosen, competition over minerals for renewable energy will decrease which may improve international relations and bring about more international cooperation. When the market weakens the focus shifts from security of supply to security of demand. Countries with mineral reserves will loose their relative power position and will need to cooperate more closely with consumer countries to sell their resources and to establish a reputation as reliable supplier of mineral resources for renewable energy. This reversed dependence can contribute to more friendly international relations. For example, it may become more appealing for producer countries to open up to foreign mining companies. The exchange of technical knowledge on the substitution, recycling and reuse of materials for renewable energy technologies also offers potential for international cooperation.

Prospects for conflict

The developments described in this paper, however, are also likely to have negative effects on international relations. Both the politicization and securitization of mineral policies increase protectionist and mercantilist approaches. To deal with the geopolitical challenges of mineral scarcity, countries will increasingly choose bilateral approaches over multilateral cooperation. Resource nationalism, state interventions and preferential trade agreements will disrupt and fragment mineral markets. Some minerals will continue to be traded on transparent international markets or via exchanges, such as the London Metal Exchange (LME), which offers futures and

[66] Korteweg, de Ridder, et al, *Op weg naar een Grondstoffenstrategie. Quick scan ten behoeve van de Grondstoffennotitie*.

options contracts for various metals, including aluminum, cobalt, copper, lead, molybdenum, nickel, tin and zinc. Other minerals, however, may continue to be traded primarily through long-term bilateral contracts based on prices negotiated between the parties. Rare earths, for example, are not traded on major exchanges such as the LME. This fragmentation and opacity in the market may result in increased inflation, higher price volatility, and fuel fears about supply constraints.[67] This will reinforce the tendency of states to turn inwards in a multipolar world and to focus on their national interest. This will further weaken the prospect of multilateral and collaborative solutions to pressure on mineral demand from the transition to renewable energy.

The return of state intervention and protectionist policies will have negative consequences for the international free trade regime. Several complaints have already been filed at the WTO against Chinese practices that are allegedly protectionist and against WTO regulation. A recent ruling stated that China's export duties, quotas, and minimum export price of coke, fluorspar, manganese, zinc, and other commodities is in conflict with WTO trade practices. [68] The WTO yet has to rule about China's measures on rare earth elements, but as many of the same measures in regard to other commodities were found to be in conflict with WTO rules, it is very likely that China will lose this case. At the heart of many of the mineral related WTO cases is the tension between mineral producing countries that are increasingly claiming the added value of their resources and the importing countries that throughout the past years became accustomed to having access to cheap minerals.

The disruption and fragmentation of mineral trade will have a negative impact on global prosperity and the availability of minerals on the market, which increases the likelihood of conflict. This is amplified by the tendency among import dependent states to align their mineral policy with other policy areas, such as development assistance and foreign policy, which means that countries risk to have conflicting interests in a growing number of policy domains.

In addition to interstate tensions, intrastate conflict in resource rich failed states or with weak governance may also increase. High mineral demand and high prices make mining a lucrative source of income for warring factions. In Congo for example, various governmental and armed rebel groups have taken control of mineral production and trade. Especially trade in coltan, which can be found in the country's eastern provinces, is funding militias and fuelling the civil war. [69]

New playing field

The transition to renewable energy and the concurrent growing demand for minerals will give rise to new players and will contribute to the multipolar power structure of the international system. First, mineral producing countries will gain power. China will remain an important supplier of rare earth metals and other minerals and may continue to occasionally use its position as dominant supplier as a strategic instrument. That China settled the dispute with Japan in its favor, may prompt other

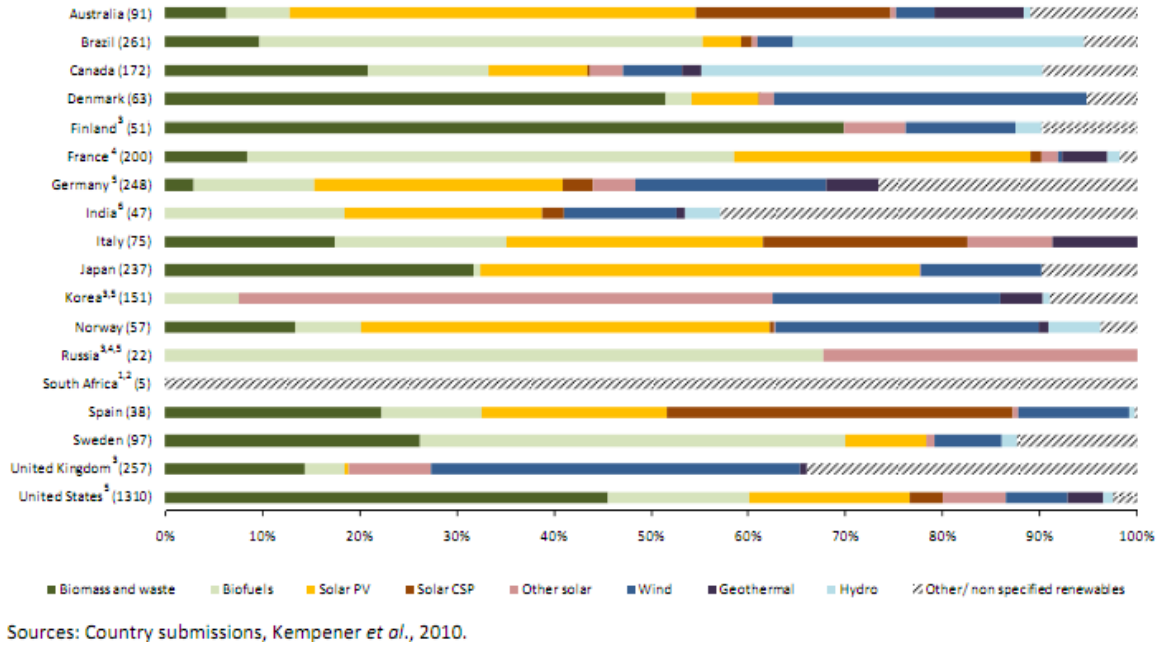
[67] U.S. Department of Energy, Critical Material Strategy (Washington, DC, USA, December 2011), 52, http://energy.gov/sites/prod/files/DOE_CMS2011_FINAL_Full.pdf.

[68] Resource Investing news, "Does A Rare Earth Trade Dispute Loom?", July 11, 2011, http://www.thestreet.com/story/11184621/2/does-a-rare-earth-trade-dispute-loom.html.

[69] The Guardian, "Congo rapes: Scramble for Africa", August 28, 2010, http://www.guardian.co.uk/commentisfree/2010/aug/28/editorial-congo-rapes-mineral-mines; Frank Melcher et al., "Fingerprinting of conflict minerals: columbite-tantalite ('coltan') ores" (Society for Geology Applied to Mineral Depostions, June 2008), https://www.e-sga.org/index.php?id=201.

resource rich countries to do the same. Other countries may see the increased strategic use of minerals in international relations as an opportunity to profile themselves as alternative and more reliable suppliers. Australia has already aimed to establish such a reputation on the rare earth market. After meeting with Japanese Foreign Minister Seiji Maehara in Canberra, the Australian Foreign Minister Kevin Rudd told reporters that “Australia stands ready to be a long-term, secure, reliable supplier of rare earths to the Japanese economy". [70]

Second, regions with large unexploited mineral reserves, such as the Arctic region and the South China Sea, will gain strategic importance. Greenland may also rise as a new center of resource competition. With its vast rare earth reserves Greenland has the potential to become the largest or one of the largest suppliers of neodymium, terbium, dysprosium, yttrium, lanthanum and cerium in the medium term (2016-2017 onwards).[71] Mineral rich developing countries, such as Bolivia (lithium), Kazakhstan (rare earths), Mozambique (tantalum), will also become increasingly important.



Sources: Country submissions, Kempener *et al.*, 2010.

Figure 8 Public spending on renewable energy R&D (2010 USD million) [72]

Third, the gravity of international relations will shift towards countries that possess renewable energy technologies and technical know-how on minerals for renewable energy. Countries with high R&D expenditures on renewable energy, such as Japan and China, and countries with strong growth in renewable energy capacity such as Denmark and Germany, will gain power. The EU has already indicated to support technological, research and industrial cooperation on energy security and low carbon energy roadmaps with key partners such as the US and Japan.[73] The Netherlands is currently

[70] Rare Earth Digest, “China softens stance on rare metals imports”, November 25, 2010, http://rareearthdigest.com/ree-news/news-global/55-china-softens-stance-on-rare-metals-imports.html.

[71] Gareth Hatch, *Critical rare earths – Global supply & demand projections and the leading contenders for new sources of supply.* (Technology Metals Research, August 2011).

[72] International Energy Agency, *Clean energy progress report*, 54.

[73] European Commission, *Key facts and figures on the external dimension of the EU energy policy*, Commission Staff Working Paper (Brussels: European Commission, September 7, 2011), http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SEC:2011:1022:FIN:EN:PDF.

investigating possibilities to increase cooperation with Japan with respect to research into recycling and substitution of rare earth elements. [74]

The biggest losers of the new geopolitics of minerals for renewable energy are the resource poor developing countries. Without mineral deposits they are be unable to profit from high mineral prices or to increase their political leverage. These countries may also lack the financial means to invest or purchase renewable energy technologies. Local industry will suffer from high commodity prices, including high energy prices, and lose its competitiveness due to a limited access to renewable energy. In the context of high commodity prices, developing countries will be primarily concerned about survival. The transition to cleaner and more sustainable energy risks to become a second order priority and, consequently, resource poor developing countries risk to lag behind in the global transition.

Conclusion

The geopolitics of minerals for renewable energy will be shaped by the balance of power and of conflict and cooperation between the governments of mineral producing countries and import dependent countries. The increased importance of the state results from the ideological shift in the international system from neo-liberal market capitalism to state capitalism.

In addition, developments on the global mineral markets are also triggering more state interventionism. The rapid rise of emerging economies is a key driver behind the explosion of demand for energy and minerals for renewable energy technologies. Population growth, economic growth, rising prosperity levels and changing consumption patterns are expected to drive demand in the coming decades. A growing share of global energy demand will be met by renewable energy due to concerns about climate change and because adding renewables to the energy mix enhances energy security. High oil and gas prices will also accelerate the transition to renewable energy technologies and further increase the demand for mineral resources.

As the supply side has been unable to keep up with the demand side, mineral prices have skyrocketed. For producer countries, high prices are an opportunity to increase government revenues to fund domestic political and economic agenda's. Internationally, their mineral resource endowment has given them a relative stronger power position and leverage. Mineral resources have become a strategic policy instrument and tool for power projection. In import dependent countries this has raised concerns about supply disruptions. Even if these countries were able to pay the higher mineral prices, their economic competitiveness and therefore their national security depend on a stable supply of mineral resources. Securing raw materials for renewable energy has becomes an important policy priority. Import dependent countries have taken measures to increase access to foreign supply and measures to reduce their import dependence.

Increasing government interference in both producer and import-dependent countries will have positive effects, such as the increase of supply, resource efficiency, substitution and recycling.

Overall, protectionist policies, however, do not have a positive effect on international relations. In addition to creating market distortions and increasing the risk of supply disruptions, protectionist

74 Ton Bastein et al., Samenwerken Aan Zeldzame Aarden (The Hague Centre for Strategic Studies & TNO, December 2012), http://static.hcss.nl/files/uploads/1131.pdf.

policies will in the end undermine the principles that underpin the international free trade regime and consequently reduce the availability of minerals on the market. This will further increase competition and fears about mineral scarcity. This will augment the chances of international tensions, a development that is reinforced by the transition towards a multipolar system in which uncertainty makes international relations inherently more instable. One of the biggest policy challenges of the renewable energy era is, consequently, to achieve economic growth and energy transition with less mineral resources.

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