

POLINARES is a project designed to help identify the main global challenges relating to competition for access to resources, and to propose new approaches to collaborative solutions

POLINARES working paper n. 44
April 2012

Part II: Future World Images and Energy and Mineral Markets

By Clingendael International Energy Program with contributions from all POLINARES partners



Funded under Socio-economic Sciences & Humanities



The project is funded under Socio-economic Sciences & Humanities grant agreement no. 224516 and is led by the Centre for Energy, Petroleum and Mineral Law and Policy (CEPMLP) at the University of Dundee and includes the following partners: University of Dundee, Clingendael International Energy Programme, Bundesanstalt für Geowissenschaften und Rohstoffe, Centre National de la Recherche Scientifique, ENERDATA, Raw Materials Group, University of Westminster, Fondazione Eni Enrico Mattei, Gulf Research Centre Foundation, The Hague Centre for Strategic Studies, Fraunhofer Institute for Systems and Innovation Research, Osrodek Studiów Wschodnich.

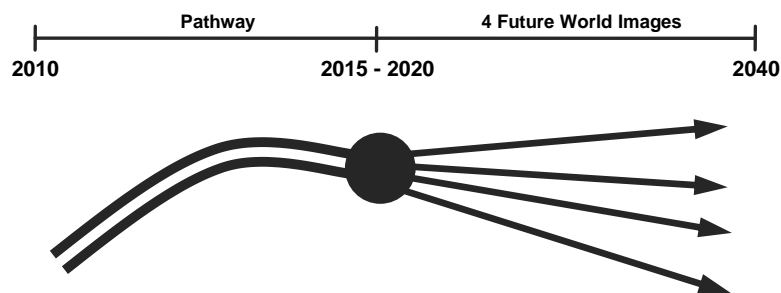
Contents

Future World Images	2
Oil markets, gas markets and mineral markets in the four future world images	22
Conclusion: identification of key future risks	31
Summary bibliography (Part I and Part II)	38

Future World Images

This part covers a reconnaissance of the future of geopolitical and geo-economic relations and the impact on energy and mineral markets and policies. This reconnaissance is done in two stages, the near future in which much more path dependency exists, and 4 storylines covering the period post 2015/2020 to 2040, see also Figure 1. The logic of the future world images also fits the analyses of the world developing in certain long cycles or waves of both economic and political governance, and analysed in WP1 and more specifically in WP2 in the modelling in POLES. The future world images sketch four potential futures and are not forecasts. Although reality usually had many shades of grey, the world images describe the more extreme possibilities belonging to such imagined worlds and their impact on the functioning of mineral and energy markets of such a different political and economic governance system, positioning the reader three decades into the future.

Figure 1: Conceptual timetable of POLINARES Future World Images



Source: Conceptual only, CIEP Analysis (2012)

In the previous work packages and the first part of this work the analysis of historical and current developments in specific areas serves to create a better understanding of today of mineral and energy markets, cooperation and conflicts of interests among the most important players. In the post-1945 period, OECD countries, and the US in particular, have been instrumental in developing the standards and norms of the international political and economic relations. They are the mores setters of that period. In the world future images (FWIs), other mores setters are considered, resulting in other governance systems, other investment practises, trade flows and geopolitical relations. These images are therefore not variations on current trends, but rather a presentation of four different regimes of international political and economic relations.

The conclusion in WP 1 was that the world is in or on the verge of a transition period, in which the share in international production, trade and finance of emerging markets is growing fast. This results in a larger weight of the emerging economies in world GDP. Moreover, the geopolitical impact of these countries is increasing, not only as a result of their growing soft power but because of their increasing hard power. The OECD countries are meanwhile experiencing a relative decline in terms of economic importance and geopolitical impact.

The stability of the cooperative and uncooperative worlds

The FWI images show a path of development leading to yet another regime for the period beyond the scope of this study. The implication is that action-reaction or balancing and re-balancing continues even though the mores of the world system functions along a set of rules for a while. The implication is that all four FWI must be considered unstable and harbouring the seeds of change for the next regime.

Another issue to bear in mind is that regimes never include all states and all other actors. There are always parts of the world that function outside the (main) mores of the system. The underground and above ground assets (in the widest sense of the word) that reside within these separate functioning entities (states, firms or other organisations) give an indication on what role they may play in unsettling the dominant regime or redefining it or challenging it in a conflictual setting.

In the cooperative world images, newly emerging countries (new in the future, not the current set of countries) may feel dissatisfied with the dominant system and their ability to prosper in it. Also, states initially following the mores of the system may feel better off when diverging from the rule set or when banding together to change the rules with other states. This also depends on the ability of the mores setters to distribute sufficient benefits to rule followers. In the cooperative FWIs the assumption is that some states play a more important role in governing the system than others, perhaps creating hegemon benefits. Yet, hegemons are pressed to share some of the benefits with other countries to continue their support and preventing them from pursuing other benefits. Also in a cooperative world the costs and benefits of governance are not shared evenly across the actors and can be source of instability. The two cooperative FWIs are not without tension and conflict but they do have mechanisms to balance diverging interests and prevent conflicts from escalating into violence. Despite these mechanisms, history has shown that violent conflicts can also occur in a cooperative world.

In an uncooperative world, power plays are more important and governance costs and benefits are even more skewed. In the two uncooperative FWIs the hierarchy between states, firms and other organisation or groups is more pronounced, creating a situation where tension and conflict arises easily. Moreover, these two FWIs fail to provide the appropriate mechanisms to defuse conflicts peacefully and the escalation into violence is only hampered by the strength of the opponent or competitor and risk by their appetite for risk. Much depends therefore on credible threats and hard power capabilities. The balance of power is much more important in an uncooperative world and can serve as a strong incentive for groups or blocks to continue cooperation. The dominant position of one country or a group of countries can be an incentive for others to join forces and re-balance against the hegemon as a group.

Another issue to consider is that all four the FWIs takes the continuing of integration of the world in the longer term to some extent as a given. Yet, we have to acknowledge that particularly in periods of transition between regimes, the world can become fairly disintegrated with regard to economic policy-making and with regard to the type of values that are shared in international relations. The impact of (a temporary) disengagement from the world system on other states and their economies can be large and lead to all sorts of responses. It is perhaps in a period of transition between one regime and the next that uncooperative regimes become reality. With that prospect, states either quickly back away from that situation and restore cooperation, moving them back into the cooperative FWIs, or uncooperative worlds become the norm for the time being.

In order to develop the future images the insights of the current themes and strategies in part I, and the cases of part III have been instrumental. Due to the uncertainty of a 'regime' change and the current instability of international economic affairs we have opted to slightly disentangle the future world images from current affairs. We have moved their 'starting date' to the period 2015/2020, which is within the logic of the timeframes developed in WP 1 for past regimes. Only by hindsight the right date for a regime change can be determined and perhaps 2008, however shocking, 'was not the mouse that sank the liberal capitalist boat', as suggested in WP1, but something else that we do not know yet or have been unable to recognise as regime changing. At the time of writing this part, too many mice were lining up for the role of 'boat sinker' to stick to the certainty expressed in WP1. Instead we have opted to let 'another unknown future mouse' to sink the boat and change the regime to avoid a discussion about mice. No doubt today that would be a very European centred mouse, while it is world developments that we need to describe.

Pathway to the Future World Images¹

The **Great Recession** that started in the US in 2007 and reached the rest of the world after the fall of Lehman Brothers in the autumn of 2008 was a slow turning point for the mores of the international system. During the period of the Pathway both the US and EU initially struggled to restore growth and employment structurally, although the US benefitted greatly from the energy boom after 2013 and began to separate path from the EU. The lack of cohesion in the transatlantic partnership with each country struggling for control over their economies was a major contributor to the decline of the Washington consensus. The emerging economies were unwilling to help out the US and EU without major concessions in the design of the multilateral system and their say in their governance. The inclusion in the boards of the Bretton Woods institutions, without a change in the power structure, was not enough. Moreover, these countries were not united in their approach to international governance, nor were they willing to share in the governance cost which a larger role in the international system would entail. The world was left to struggle with the changing political and economic structures in the years following the Great recession and that lasted until 2015/2020.

The period of the Pathway thus describes the slow end of the old regime and the appearance of a new one. As with past experiences in the twentieth century that saw political shifts rapidly follow economic decline, the change in regime can be established in a relative short period of time, but both in the 1930s and the 1970s, it still took more than a decade for the change to materialise and the system to stabilise. In the 1930s, the Great Depression and WW II eventually led to the United States taking over as the leading power, although the UK was intensely involved in discussions about the post-war order. A change in regime does not necessarily require a drastic change of hegemon, more often we see a change in the relative power of a hegemon and emerging powers, which gradually results in the change of hegemon after a period of rebalancing.

¹ From here on, we depart from reality and enter into the storylines on how things could develop. They have been written in the past tense, as if we are looking back on the period of the pathway in an attempt to create 'future history'. In the pathway some real events are woven into that story. In the storylines, the reader is placed somewhere between 2030 and 2040, well into the new regime belonging to that storyline.

Pathway Power plays

The Great Recession left the **American economy** seriously weakened. With its budget deficit reaching unprecedented heights, serious expenditure cutbacks were necessary. Support for the high level of defence spending, against the backdrop of reduced social spending, while unemployment remained high, was declining rapidly in years of the Pathway. The result of the war on terrorism in economic terms was increasingly disappointing, if not outright damaging for the political underpinning of foreign policy. Although American companies initially had gained large contracts in Iraq during the occupation, when it came to gaining access to Iraq's vast energy reserves, companies from other countries were awarded most of the contracts. The Iraqi government had been keen to diversify among the stakeholders and the political interests they represented. Afghanistan, despite sitting on considerable mineral resources, was too divided and ill developed in every aspect of society to hold any promise for economic benefits for US companies any time soon. The American policy was to plan withdrawal from both Iraq and Afghanistan and declare both state sufficiently stabilised for local authorities to take over.

Interestingly, the Arab spring that commenced in 2011 made the region around Iraq far from stable, but the willingness to intervene on the ground was absent. The Libyan version of the Arab spring thus provided an interesting twist to the new foreign policy posture of the US, leaving most of the action to its European NATO partners, with the US in the role of flight coordinator. In the mean time, the uprising in Syria was left to diplomatic efforts.

The role of Iran also demanded attention; economic sanctions were tightened to include its oil trade to persuade Iran to give up its enrichment activities. The combination of the Arab spring and the unrest about the nuclear ambitions of Iran created tenuous relations in the region. Iran threatened to block the Strait of Hormuz, endangering the large crude oil, oil product and LNG flows coming out of the Gulf. Although some alternative routes exist, a blockage of the Strait of Hormuz would be especially damaging to economies in Europe and Asia, where most of the energy flows from the region go. Although the likelihood of Iran using the trump card in the short term and the ability to sustain a blockage for some time must be doubted, oil prices responded upward in the face of these political tensions. The American naval presence in the Gulf was intensified, perhaps also to calm Israel and prevent them from taking pro-active measures.

The American withdrawal from the Middle East is not easy to realise, and requires a substantial presence other than ground troops. Yet, it is the willingness of the US to intervene that matters in these regional power plays. Neither Europe nor Asia is able or capable to secure its oil and gas flows from the Middle East without geopolitical and strategic backing from the US. Although the US still has vital geostrategic interests at stake in the Middle East, these interests no longer can be defined in terms of physical barrels of oil or tonnes of LNG. With the decline of structural energy import dependency, the US no longer relies on these flows, but can source what it needs from the Atlantic basin. Nevertheless, it does have a strategic interest in securing the flows for the global energy markets in order for its allies to source from the Middle East through a liquid international energy markets. Moreover, the US wants to support the interests of its companies engaged in all sorts of trade, investments and services in the region and, importantly, to stand up for its allies in the region. In the longer term, China and perhaps India may want to rely less on American efforts to secure energy flows alone, particularly

when they feel that their interests are not fully represented, and either support US actions in the region or replace the US to secure their own flows.

New conflicts, among which unrest in Asia regarding the South China Sea and Taiwan increasingly drew attention, although the 'smaller' Southeast Asian countries began to bundle their interests by joint operations in the energy sector, and further stimulated a US retreat from active or central involvement in Central Asian and the Middle East to keep their hands free in this important region. Instead, more of the hegemonic tasks were left to US proxies and/or new coalitions. Consequently, the governance costs increased for these countries without being able to reap clear benefits from them because they were not really in control of the situation. This posed a major problem for the EU, not least because they were at the same time pressured to relinquish some of their power position in international institutions to accommodate new powers.

The volatility of world oil prices in the period further dented the purchasing power of global consumers, and increasingly the foreign and security strategy of the US government was questioned in the political debate. The cost of the Iraq and Afghanistan wars weighed heavily on the political classes, particularly when American economic interests elsewhere in the Islamic world came under duress. The socio-economic pressures in these countries and the political backlash on the mainly authoritarian regimes had ousted many of the old leaders and replaced them with more radical, Islamic oriented regimes that took a dimmer view of American influence, both political and economic. For the United States, it appeared as if they faced a 1978 Iran rerun, but this time across the bulk of the Middle East, East/Central Asia and North Africa. The US opted to switch from a projection of its hard to softer power and expose others more as using hard powers.

It was exactly what the US eventually proposed to do, leaving the management of regional stability to allies in the region and the other powers to sort out. Consequently, the governance costs in these regions increased tremendously; none of the other powers had the capacity to take over the role of the US without diverting substantial expenditure towards their military capacities.

Despite the energy boom, the large American budget deficit still necessitated considerable social spending cuts in order to leave taxes largely untouched. This had further weakened the social safety net and impaired the social fabric of American society, further kindling a discussion about the cost of projecting global hard powers on behalf of other nations' interests. Reference to China's rise and expansion in resource industries around the world were often used as an example. The lesson from the Iraq intervention was clear. Increasingly, American support came at a larger cost than supporting in name the virtues of democracy and American style market approaches. Access to the American market was directly linked to the level of participation of a country, in an attempt to stop piggybacking on the US efforts. This had resulted in the Chinese Renminbi appreciating against the dollar.

It was clear however in the immediate years after the Great Recession that the cost of Security of Supply was increasing for oil and natural gas net importers around the world, with the US in relative retreat as the most active guarantor of the free flow of oil and gas. Moreover, the United States was blessed with sufficient domestic energy, both fossil and renewable, to justify a re-focussing of their Security of Supply efforts on the Atlantic basin, leaving the Middle East, North Africa and Central Asia for others to manage.

The EU had also been greatly weakened by the events following the Great Recession. After much wrangling over keeping the euro intact, the sovereign debt crisis had eventually posed the dilemma to temporarily allow countries to re-balance outside the euro and return later or to massively support these member states with necessary capital flows to finance their internal reforms. This choice between external or internal driven reform was a major point of contention among the member states and how to come up with a credible answer to the crisis. This debate lasted a couple of years. The costliness in terms of organising sufficient financing power to finance the time needed for structural restructuring of the Eurozone economies depended largely on the willingness of other powers, such as China, to support this effort. In return, Europe lost much of its multilateral privileges.

The American inability to commit large resources to the interventions in the unrest stemming from the Arab Spring had created more pressure on the budgets of the EU countries. Also the impact of the economic crisis on ambitions of countries in the Balkans and East Europe had been frustrated and had led to political unrest that the EU had a hard time to stem. In a period where austerity ruled, the string of fires to put out created even more duress for the member states' budgets. Both Italy and France were heavily involved in managing the changes place across the Mediterranean, in an attempt to both look after their and their companies' interests, and to stem the flow of refugees. Turkey became a very active player in Mediterranean affairs, in part to manage the unrest in Syria and in part to extend its reach in East Mediterranean affairs, which now included natural gas resources. The conflict with both Cyprus and Israel about the exploitation of the offshore gas fields, also involved Lebanon, and required further EU security activity. Increasingly the conflict over Cyprus became a stumbling block for the accession talks. Turkey's appetite to bring these talks to a quick result faded away in this period and ended up on the back burner. Instead Turkey became a major uncertain factor in security of transit issues, from a EU point of view, in part because it soaked up quite a bit of the available gas for its own market. Nevertheless, the EU's idea to develop a southern corridor to bring gas from the Caspian Sea region and the Middle East had to be downplayed. In East Mediterranean issues Russia was also a major player, not in the least because of its need to maintain access to open sea through the Bosphorus.

The increasing challenges to the EU's foreign policy posture in the south further stressed the inner cohesion. The way the crisis in the Euro area had played out had left the southern countries smarting from the lack of solidarity, leading to increasingly national or regional actions that left out the other member states. Greece gained in strategic importance when the East Mediterranean power struggle played out. Its economic weakness had caused the country to drift further apart from the rest of the EU. The struggle over the energy interests in the Cypriot waters was initially a welcome diversion from the internal socio-economic problems, but very soon became another drag on its recovery. Despite the obvious geopolitical consequences of the brewing regional conflict, the US persisted in its non-interventionist position, urging the large member states of the EU to take their responsibility instead. While the northern EU states, including Poland and the Baltic states had found a workable strategic partnership in the Baltic, France and Italy had difficulty to find a similar approach in the Mediterranean because of clashing Greek and Turkish interests. Increasingly they managed their relations with Russia through Bulgaria and Romania, as the main entry points and the Balkans as transit countries. Divided on the major strategic issues, the EU found it difficult to align with one or the other major power, including with regard to Europe, the somewhat aloof US. The lack of cohesion in EU foreign policy issues regarding Russia, Turkey, and the North African countries, further weakened the move towards a political union.

With the partial breakup of the monetary arrangement in the middle of the decade following the economic and financial crisis, the EU member states increasingly began to make exceptions to the 'acquis' to fix temporary imbalances. In some cases, member states declined to implement policies, particularly with regard to what they defined as strategic sectors. Energy policy became more and more contested ground when member states wanted to first extend, and later leave the 20-20-20 policy, hoping that the volatile oil and gas prices would be sufficient stimulus for alternative resources to be developed. In the northern member states that was the case, but in the weaker eastern and southern member states, the introduction of alternatives became too much of a drag on government finances when financial markets were reluctant to finance these investments. Carbon leakage and the focus on short-term economic problems had taken the steam out of the sector in these countries. Only local small-scale initiatives persisted.

A 'EU light' version began to emerge at the European edges, focussing mostly on free trade and services, and a more controlled market for labour, which could easily also be dealt with in a different type of relationship than membership alone.

For Turkey, the uncertainty about what exactly they were entering into also played a role in not pushing too hard on EU accession, while on its own it was gaining regional political and economic importance. Turkey increasingly exerted its regional power in the East Mediterranean, Black Sea and Middle East. The conflict with Greek Cyprus, Greece, Lebanon and Israel over the exploitation of offshore natural gas resources further soured relations.

China had continued to grow in the period of the Pathway, but the Great Recession and its aftermath had taken much steam out its expansion. The conversion to domestic demand driven growth had been difficult. Initially, domestic demand had been strong as a result of rising incomes that could partially replace depressed export markets. As a result property and share prices initially continued to rise, driven by the ascent of new middle classes that the government did not dare to frustrate. Yet inflation was eating away at the hard won real income improvements and it became much harder to maintain welfare levels. Rising production costs and the slow appreciation of the Renminbi began to impede on the competitive position of the manufacturing industry in world markets. Chinese manufacturers began to increasingly look abroad and to west China to relocate their factories. The shift of manufacturing centres to the west of the country, intended both to remove some of the stress of newcomers flocking to the coastal areas and to open up lower cost areas, was, however, insufficient to counter the growing disenchantment of large groups in society wanting to make the economic ascent. With the stress on the economy intensifying, dissent among the government elites was growing on how best to deal with the socio-economic strains. The ever-larger sums of capital that were transferred for socio-economic reasons were draining the government of much needed policy options. Also, the Chinese government had difficulty dealing with its aging population, making labour more expensive and social expenditure vital. Instead, the government increasingly obscured cost and price signals, making the Chinese consumer very dependent on government spending.

The local banking system was in dire need of reform. A large corruption scandal in the banking sector, involving many politicians, led to a cascade of consequences, not least the bursting of the housing and property market in the second part of the decade following the Great Recession. Again the government was forced to step in and save local governments and banks alike from bankruptcy. Not unlike the American and European governments before them, the Chinese government had great difficulty in

explaining why it felt compelled to save larger companies, while house-owners and small companies were left to suffer from the sharp property mark down.

The virtual withdrawal of the US from the Middle East had exposed China to larger security of supply problems in oil. Despite its large investments in Africa and Central Asia China relied to a large extent on Middle Eastern imports. Security of transport became a much larger issue when tension rose in the South China Sea, in addition to Middle East concerns. The large imports of crude oil (above 80% dependency) became a much larger burden on the economy, making it harder to maintain a positive balance of trade. The pressure to develop domestic resources was substantial to manage the import bill.²

Countries, such as **Brazil and India**, less exposed to the financial markets of the US and EU, managed to digest the Great Recession with less ‘indigestion’, although some of the Indian international investments performed very disappointingly. Despite infrastructure gaps, India’s internal market continued to grow steadily, and remained the bedrock of South Asian growth throughout the Pathway. India’s sound relations with Saudi Arabia, Qatar and Iraq provided sufficient security of supply in oil and natural gas, in addition to modestly growing domestic supplies. Brazilian growth was also based on the domestic market, although its increasing energy exports in this period of the Pathway gained prominence. It’s crude oil, renewable energy and agricultural exports expanded, leaving the country with a very healthy balance of payments and fiscal surplus. It became the dominant political player in Latin America as a result. The orientation of the US on Atlantic energy and other raw material markets and the access of international companies to part of the equity helped the expansion of these industries along. Brazil and India became the stable economies in the world, steadily following their own path.

Mineral and energy markets

With international growth less buoyant than before the Great Recession, it was, in principle, easier for **energy and mineral supply** to keep up with demand growth. Nevertheless, the replacement of current production still required large investments in new production capacities, particularly because domestic demand for energy in many producing countries continued to increase. Without additional investments, the oil export capacity would begin to decline. The license to export was however increasingly based on satisfying domestic demand first, despite the fact that relatively high oil prices for exported oil were a main contributor to the government spending plans. The ability and willingness to keep up investments in **oil production** declined however in some countries, when creating jobs for the relatively young population became the prime priority in some oil producing countries. Despite somewhat slower growth of demand, oil markets remained tight throughout the period of the pathway, also because countries such as Saudi Arabia were unwilling or unable to finance the world’s required 5% spare capacity. With no credible replacement for the role of swing producer, oil prices were volatile throughout the decade.

In this decade after the Great Recession, subsidies on energy demand in the producing countries still consumed at large part of their export income.³ In countries such as **Saudi Arabia, Kuwait, Qatar, the United Arab Emirates**, other fuels other than oil were slowly introduced into the energy mix, in

² See Part I Figure 6 for the development of the oil import bill for the main consuming and producing regions from 2000 – 2010. Source: ENERDATA (2012),

³ International Energy Agency, *World Energy Outlook 2011* (Paris 2011) Chapter 14, pg. 507,

part to maintain crude oil and gas export capacity. The Emirates and Saudi Arabia embraced nuclear energy as a major new contributor to electricity generation and desalination, while Qatar and Kuwait focussed mainly on renewables and gas. Interestingly, Kuwait contracted a large part of its gas from Iraq, helping to reduce some of the flaring in the southern province by creating a market for the gas. In combination with solar energy, it managed to maintain its crude oil export capacity. Saudi Arabia's eastern province was also connected to the new gas grid, helping to sustain the industrial demand for associated gas and desalination.

Australia continued to develop in Asia's energy and mineral supplier, although the part of the population was increasingly wary of the climate change contribution of this nation through the expansion of its resource sectors. In an effort to manage the political dissent with the resource export strategy major efforts were made to increase the contribution of renewable energy to the energy mix. With its expansion, Australia was a welcome source of diversification of supply for China, and also reduced some of the pressure to invest more in the production capacity in the Middle East. Together with the US, Australia developed into the suppliers that could provide a cap on prices spiking, a role in a previous period played by North Sea oil.

The countries in the Middle East were grappling much of the decade after the Great Recession with the **after effects of the Arab Spring**, requiring more investment in social spending and the creation of jobs. In that respect they were less sensitive to the needs of the international economy for reasonable prices. In the first few years after the Arab Spring, governments struggled to control developments. Some governments, after the situation in their country had stabilised, began to relax controls over society and began to allow more private enterprises to come into existence. In Saudi Arabia, young people were stimulated to apply for start up capital to launch companies. These companies were clustered around the many universities in the country, akin to the technological hot spots such as Silicon Valley, later to include the many vocational colleges to also include other types of entrepreneurial initiatives. Slowly the Saudisation of the economy began to take hold at all levels of the labour market, offering the needed license to continue exporting oil to world markets. An important part of the Saudi programme was the opening up of society, and a crack down on anything that smelled of clientelism. Other countries in the Gulf went through similar developments, with the exception of **Iran**. The isolation of Iran had seriously reduced the capacity to modernise its economy, despite efforts by Russia and China to bring the country back within the mainstream of the international political system. The rift over Iran's nuclear programme continued to isolate the country and was a source of deepening strategic regional concerns at to Tehran's intentions. As a result, poverty increased and the country experienced several waves of social upheaval. Investments in its energy industries were suffering, and for the first time in decades, Iran could no longer keep up with Iraqi oil production.

The **US energy market** had made a dramatic turnaround in the years after the Great Recession. With demand pressures declining structurally due to new standards on car energy efficiency, supply was growing due to the availability of biofuels and the boom in unconventional production. The initial revolution in shale gas production, reversing the US outlook from structural import dependency for the natural gas to a development into an exporting country, quickly expanded to oil when gas prices alone could not support shale gas production. Shale gas developed into those deposits that also produced gas condensates (wet plays), using the higher return on oil production to realise the return on investments. In the mean time, natural gas prices became very low indeed, particularly when compared to prices in

the rest of the world. Shale gas potential elsewhere existed but during the Pathway, no other country was able to replicate the American energy revolution. In Europe, political and particular stakeholder concerns about the impact of lower prices on their sustainable energy drive hindered exploitation of certain shale gas potentials. In some countries, shale gas production was forbidden for political environmental reasons, often with the argumentation that the technology was too new and not reliable. Yet, most of the technologies involved had been practised in drilling for many years, also in the EU, and also in the countries that now doubted the merits of the technologies. These countries could potentially have benefited from their close proximity to a fine network of natural gas infrastructure, which had helped the American industry to take off so quickly once the technology was dispersed. Instead, the shale gas potential that was developed in the EU was much further away from infrastructure and markets and therefore more costly to produce. Politically, these developments in the periphery of the EU were less seen as a threat to the new energies that were being introduced in the mix in mainly Northwest European countries.

After the major capacity additions to natural gas production, both in shale gas and LNG, and the drop in demand during the Great Recession, the **natural gas market** recovered quickly. It offered countries a relative clean fuel for industry and electricity generation. In emerging market economies, such as China, local pollution had initially stimulated gas demand, and the convergence in price with coal made inclusion of gas in the mix easier. The development of domestic shale gas resources in China also stimulated wider gas demand, while imports from Central Asia were a welcome addition to diversified supplies. Nevertheless, the hope to quickly realise the shale gas potential was dampened somewhat by water shortages. In Europe, gas demand recovered mainly due to buoyant demand in Germany and other North European countries. Natural gas was a robust choice for investors in generation capacity to fit in with the anticipated climate change policies of the EU, while in the US, the natural gas market continued to enjoy the boost that shale production had given to the industry. Qatar was the single largest LNG exporter, and supplied both the Atlantic and Pacific market. Other LNG suppliers had a more regional market focus, but were connected to spot markets. With the expansion of the Chinese gas market, Russia finally developed pipeline infrastructure to China, one a connection to the central Chinese gas market and the other to Beijing, pretty much following the structure of Nordstream and Southstream, drawing on different stakeholders in each pipeline.

In **mineral markets**, new investments, which were also more geographically distributed, and lower demand from developed economies, had temporarily reduced the pressure on most of the mineral supply. The highly concentrated mineral markets, with only a few suppliers, had increasingly come under government scrutiny, and only more and more dispersed investments, including processing, had staved off national control tendencies. In some importing economies, life cycle approaches began to take hold as part of their import management and climate change policies, and led to more recycling and secondary production. The development of a new generation of new materials further reduced demand for minerals.

The risks for Europe are mainly of an economic nature, in part because of its lack of credible geopolitical posture. The EU is struggling with its structural import dependence on Russia and has been unable to forge a stable regulatory and investment environment with Russia to reduce its concerns.

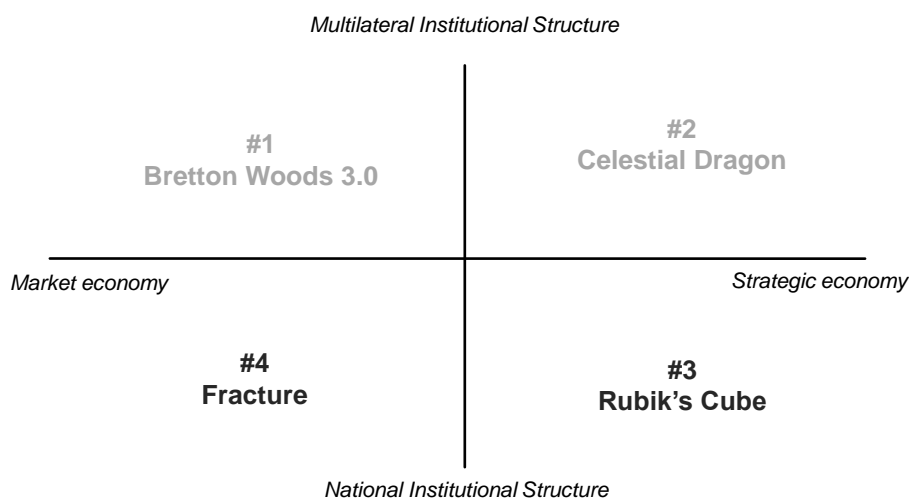
The capability of some member states to generate sufficient investments to stay on track on the green agenda is worrisome, while also the traditional energy investment climate is highly uncertain. A two-track or multi-track Europe is no longer unthinkable, in which the competitive position industry and protection of employment have returned as drivers of the energy and resource agenda. Further asset sweating of energy systems, and the inability to absorb higher prices of energy, lead to growing energy poverty in certain regions. Many European economies are vulnerable to price and volume risks in energy because the period of adjustment is too short to find substitutes and the economic capacity to change is limited. It is clear that the period of transition, that the pathway represents, has positioned countries differently for the post-2020 era.

Post-2015/2020: four future world images

The FWIs have two principal dimensions: an economic axis (prevalence of market forces; prevalence of State forces) and a political axis (integration and globalization; and competition and regionalization), see also Figure 2. They present two cooperative world images and two more conflictual ones. In WP2 the interface between quantitative analysis and the qualitative analysis of WP2 and 3 for the FWIs were presented. Here, the WP3 qualitative descriptions of the FWIs were linked to quantitative parameters. For further details see: “Future availability and demand for oil gas and key minerals” by Kimon Keramides and Alban Kitous (ENERDATA) in POLINARES D2.1 report section 18.

The FWIs describe the possible new mores of the international and economic system in their more extreme forms. All four images require a certain ‘event’ (as in a coalition agreeing or deciding to do or end something that has hindered developments; or can perhaps also seen as a deal between countries to structure the re-balancing in a certain manner) to become reality. These events or deals can be political, economic or both, but help the mores setter(s) to govern (or not in the more conflict-ridden FWIs) according to the new mores and force other countries to follow suit.

Figure 2: POLINARES WP3 scenario framework



Source: Conceptual only, CIEP Analysis (2012)

#1 Bretton Woods 3.0

This quadrant describes a world in which the major powers have converged on a new set of, rule-based multilateral mores, rule-based, where balance of payments equilibrium (trade and financial flows) is central to managing rebalancing in an orderly fashion. In a new agreement, the IMF and WTO are calibrating their policies to achieve major power economic balance and exchange rate stability. Part of this agreement is that excessive deficits **and** surpluses are subject to intervention policies, finally fixing this design flaw in the international economic governance system. To some extent, the world is returning to the more successful days of the first Bretton Woods system, with more discipline or governance over capital flows. The world has moved away from using a national currency as reserve and intervention currency and instead has converted to a world where a basket of major power currencies, the SDR, is used in international capital markets and trade. The move away from the dollar has taken place in an organised manner, without major disruptions in the value of the Green Back. This was done by slowly converting oil trade to a basket currency trade in a tripartite collaboration between the US, China and Saudi Arabia, thus forcing other countries to follow suit.

The **new agreement, was quickly dubbed Bretton Woods 3.0**, did not come about easily, because many of the new powers were major holders of American treasury paper and feared a major loss of value. But when the US threatened to impose a surcharge on certain crucial foreign goods and raw materials, and completely withdraw their troops from the Middle East and Central/East Asia late in the first decade after the great recession, the agreement was fairly quickly hammered out between the US, China, Brazil, Russia, the EU and Saudi Arabia. A withdrawal of the US from the centre of the geopolitical play would reduce the ability of other powers to balance against China, while Beijing was increasingly grappling with internal dissent and its exposure to security of supply risks. The US thus became the balancer rather than the enforcer of the international mores.

Rejuvenating the Bretton Woods institutions

The **new agreement** laid the basis for a radical overhaul of the international governance system, repairing systematic mistakes and returning to an open trade and rule-based system. Governance costs are shared more equally among the major powers, including security costs. Brazil and India are made permanent member of the UN Security Council, while the European seats were eventually bundled into one. That came about once the European Union had agreed to continue on its path of deeper integration as part of the agreement negotiations. Similar regional agreements were developed among other groups of likeminded countries. Tired of the continuous bilateral conflicts over a wide range of issues, the time had become ripe for a more cooperative position. Issues such as climate change and water management, which had been in stalemate for many years, were immediately put on the international agenda. Funds were made available to help countries comply with the new policies, adaptation, and to make up for lost time on emission reduction schemes.

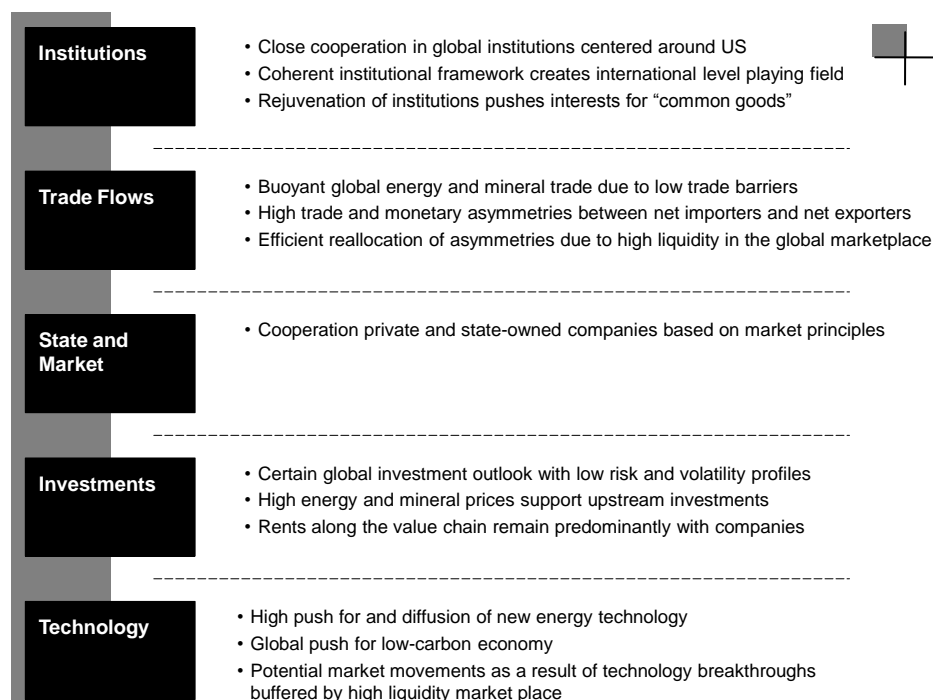
New trade and technology rules were agreed and a new type of world trade and services organisation was set up to incorporate market incentives for new technologies for food, energy and resource production. The most important breakthrough was the abolition of national subsidies and tax systems in the energy and mineral resource sectors, and the removal of strategic competition. Boards were set up to monitor investment, demand and production needs and these results were made available

transparently. The introduction of full cost assessments and the principle of fair returns for each stage of production helped to stem fears for scarcities to come about. The importance of rewarding resource efficiency and recycling was acknowledged. Tax systems were based on environmental footprints, making consumers more aware of the cost of their lifestyles.

Festering conflicts in the South China Sea and the East Mediterranean, the Middle East and East Asia were among the first that to be settled under the new mores and they were the litmus test for the new order to work.

With the new agreement in place, the EU was given a new lease of life, although the 'Acqui' was substantially adjusted to accommodate and incorporate the new realities. The EU was transformed in the 'EU federation'. The democratic deficiencies were fixed to create a different public support system for decisions made at the EU level, and to gain a license to operate trade, foreign and monetary relations at the federal level. The Commission became an elected body of 100 members representing the member states. Each member state had, according to the population, at least two and at most 4 representatives in the Commission. Together with the European parliament, where European wide political groupings were represented, they were the democratic control bodies for the new federal government, called the Council. The President of the Council was directly elected and formed his appointed Council, which had to be a fair representation of the member states in terms of diversity to gender and nationality. Each Council member had to have a good working knowledge of three of the language of the other important groups of countries in the world, Spanish, English, Chinese, French, Arabic and Russian. Other world powers would make similar demands on their officials to create a better understanding of each other culture.

By 2025, the US had benefitted a lot from the much reduced energy import dependence, its economy was strong and jobs had returned to the US. On the demand side, high oil prices in the years prior to the agreement had effectively pushed energy efficiency forward, also reducing CO2 emissions. Dependence on Middle East oil had declined rapidly, and when American debts forced the US to make hard security choices, it threatened to abandon the Middle East and East Asia, shifting the security of supply risks fully onto China, India and to a lesser extent the EU. The EU was largely dependent on Russian supplies of gas, but this posed no strategic problems because Russia had increasingly adopted a rule-based open trade stance, once its own companies were strong enough to compete internationally. As a matter of fact, Russia had been a strong proponent of the agreement, liaising between the US, EU and China to come and sit around the conference table. Russia had a lot to gain from a cooperative world. With a relatively small population in such a large country, it had mounting difficulties to secure its borders. In a more open system, where sovereignty was respected and resource exploitation less of a national strategic issue, Russia could fully exploit its energy and mineral riches.

Figure 3: Development of WP3 themes in Future World Image “Bretton Woods 3.0”

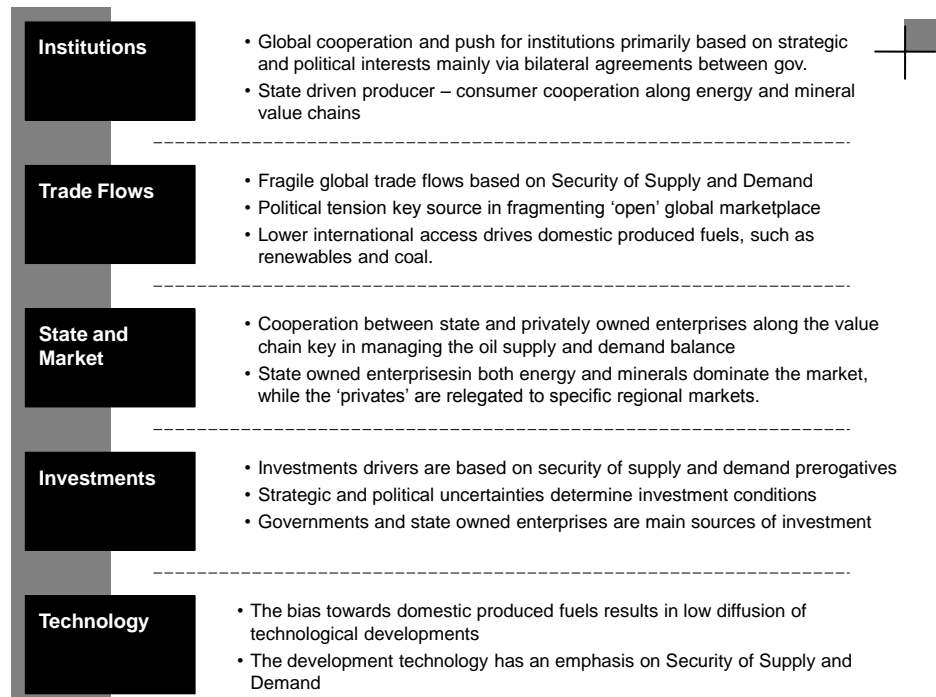
With the establishment of the new international order, access to energy and mineral resources and markets became more open, helping both producers and consumers to achieve a higher comfort level. Energy demand in countries such as China continued to rise, feeding growing oil (and to a lesser extent) natural gas bills, and the interdependence of the Middle East and Asia. It was the growing energy import bill and the accompanying balance of payments constraints that helped forge the Bretton Woods 3.0 agreement, when instability in the Iran/Afghanistan/Pakistan region drove up risk premiums.

#2 Celestial Dragon

In this quadrant, China has become the largest economic power, and has slowly replaced the US as the main player, and a more managed world is introduced. Yet, the US remains as a very important counter force, not unlike the UK was after the WWII. It is clear however that the economic dynamism of the Chinese economy is setting the pace of international developments, although the Chinese have to take the interests of the other players increasingly into account as well. The crisis over Taiwan and subsequently the South Chinese Sea, after substantial finds of natural gas in the region, was finally resolved when the US conceded it was unable to decide that conflict in favour of the smaller South East Asian countries. Instead, it negotiated an agreement with China, allowing Chinese state companies to obtain large minority shares in all resource developments in the area on the basis of right of first refusal. American companies could also gain a small share, bringing the Sino-American participation to no more than 49%, leaving large minority shares for other companies/countries' NOCs.

The conflict between China and the US had been very costly in economic terms, because the countries had been combating each other as much with their naval power as with protectionist economic measures. As a result, China had seen an important export market disintegrate. Instead it had to focus its exports on European, Middle Eastern and Latin American markets, but these markets could not replace the US in terms of dynamism and depth. The southern European countries had experienced a long period of stagnation after the (partial) demise of the Euro and the northern European countries, although growing healthily, could not compensate for the loss of demand from the South. China had managed to successfully switch to more inward growth, but was meeting new limits to its growth, due to the growing international trade and investment barriers. Increasingly, reciprocity was an oft-heard term for Chinese companies and officials when negotiating foreign direct investments. The Chinese economy could no longer be fed with raw materials and energy through the old strategy of equity investments and control of foreign exploitation. With the US no longer actively policing the free flow of resources, the Chinese became more committed to devising a new international system in which the Chinese economy could prosper. Yet, the political and socio-economic construct in China did not allow for a course of development along the old Bretton Woods lines. The outcome of the China-US summit in the Chinese resort of Celestial Dragon was instrumental in setting the new mores. Importantly, the Chinese remembered the cost of holding so much of their reserves in American Treasury bills, and the loss of value of these reserves when Washington entered a period of more inflation. A precondition for more openness and multilateral cooperation was that the Renminbi would be allowed to become a reserve currency alongside the dollar, also offering the advantage of seigniorage and ability to discipline other countries. In return, China would carry more of the governance costs, and promised reciprocity with regard to access to markets and resources, but that these issues would be negotiated rather than arranged through markets.

In close cooperation with the US, China decided to restructure both the international political and economic system. They also decided to include more emerging powers such as Russia, Brazil, India, and Saudi Arabia in the permanent membership of the Security Council, the boards of the Bretton Woods institutions, and the Basel Committee. In order for the agreement to come about, the US had to concede that national companies would continue to play an important role in the world economy as a way to manage capital flows and investments. The US had preferred such a role for the IMF to guide and direct capital flows when imbalances threatened to become too large, and otherwise let markets sort out trade and capital flows, but China had insisted on control closer to home. Its lesson from the Great Recession had been that such power should be held close to the chest of the domestic market and government, despite the argued cost benefits to pool these functions. Multilateral cooperation did become more strategic in nature, because it involved a negotiated exchange of goods and services, management of capital flows, and resources to serve the strategic interests of those carrying the brunt of the governance costs. The Chinese military increasingly operated in joint operations with the US to stabilise world markets and politics. The aim was to make sure that strategic goods and services would be available, notably food, energy, water, and certain technologies.

Figure 4: Development of WP3 themes in Future World Image “Celestial Dragon”

#3 *Rubik's Cube*

In this quadrant, the world has aligned itself in various competing blocks, where trade, investment, and financial markets are governed by rules of the group rather than by a global system. The Most Favoured Nation principle has been largely abandoned in the conflicts over the approach to resolve the Great Recession and the subsequent management of the sovereign debt crisis in the US and Europe. Increasing tensions over exchange rate manipulation and barriers to trade in order to protect domestic production and employment had caused serious impediments to the trading system. Rapid escalation of the practise to declare a sector of strategic importance, include the food, energy and renewable technologies, and a large of mineral and mineral processing sectors, undermined trust in the global system. National companies were rapidly becoming the main actors in the economy in many countries. The state is strong and economically very active. In some countries the government ruled through very tight regulations, in other countries through ownership.

The debt crisis caused large banks to be the first group of companies to be virtually nationalised, later followed by other companies that were deemed of strategic importance. Soon, the Most Favoured Nation principle was reduced to include only the Alignment Partners. It remained an unstable arrangement because countries grouped together around certain interests or policy approaches. The blocks were not stable because some countries keep switching alliances. Yet, the blocks cooperated bilaterally to overcome surpluses and deficits in certain goods and services. This cooperation was not market-based but settled at the political-strategic level, and therefore led more easily to regional or inter-block conflicts. Particularly in weaker alliances or in alliances with shifting membership, the number of and severity of conflicts was distinctly higher than in previous decades.

Many of the conflicts were tussles in the strategic-economic sphere, mainly over issues in trade and investment, but sometimes also involve military conflicts. Food, water and energy were particularly vulnerable to becoming subject to conflicting claims, when uneven scarcities grow. Siphoning off water from international rivers has become problematic for countries downstream with large agricultural sectors and hydroelectricity expanding in upstream countries. Also biofuels and biomass sectors are increasingly pressured because of water scarcities. Industrial products are traded, but the major blocks have increased their capacities to produce many goods domestically. Trade policies and exchange rate policies are used to protect these industries. The specialisation of China into the world's factory is reversed from the extremes of the decade of the great recession to a more balanced distribution of production capacities.

China and India were blocks by themselves, but experience difficulties in aligning countries to their mores. The deep-seated fear for of domination by rather than cooperation of with the larger countries has prevented the smaller countries to from comfortably aligning in the region, and instead they sought alignment with more neutral countries and the US. Rivalry among countries in South and Southeast Asia was large, and cultural and religious divides were hard to overcome.

North America (US, Canada and Mexico) formed another important block, while Brazil, Uruguay and Argentina also managed to align their interests. Cooperation between these two important groups was the most important counterweight to China. Other southern and Central American countries formed looser relations with both North America and the South American core block. Some Asian countries were drawn more to the American alliance than to closer cooperation with neighbouring Asian countries.

In Europe, a core of 24 countries, joined by some associated countries in a looser alliance in the Balkans and East Europe also formed a group. After the EU experienced a deep crisis in the aftermath of the great recession, where the monetary and economic union had to be virtually abandoned, regrouping had started based on the customs union. With the lessons of the decade after the Great Recession fresh in mind, the renewed efforts to integrate were much more bound by hard criteria and transfer of sovereignty. The democratic deficiencies were repaired, preparing the EU for political federation in this time of Rubik's cube. The advantages of creating at least a sufficiently large market and negotiating power with other blocks had been the main driver for the integration impetus to come about again. The lack of natural resources was one of the main worries of the policymakers because it required continuous negotiations with other blocks to trade their surpluses. The food surplus of the EU was one of the largest assets. Belarus, Ukraine, Romania and Bulgaria were in a new partnership relation allowing them to catch up economically before contemplating full membership, and had grown into important sources of bio fuel and biomass.

Russia and the Central Asian countries are among those that function between the various blocks and trade with everyone. Their 'neutrality' is important because they increasingly developed into a major resource-clearinghouse for the resource short blocks. The GCC countries have taken a similar position on natural gas and oil.

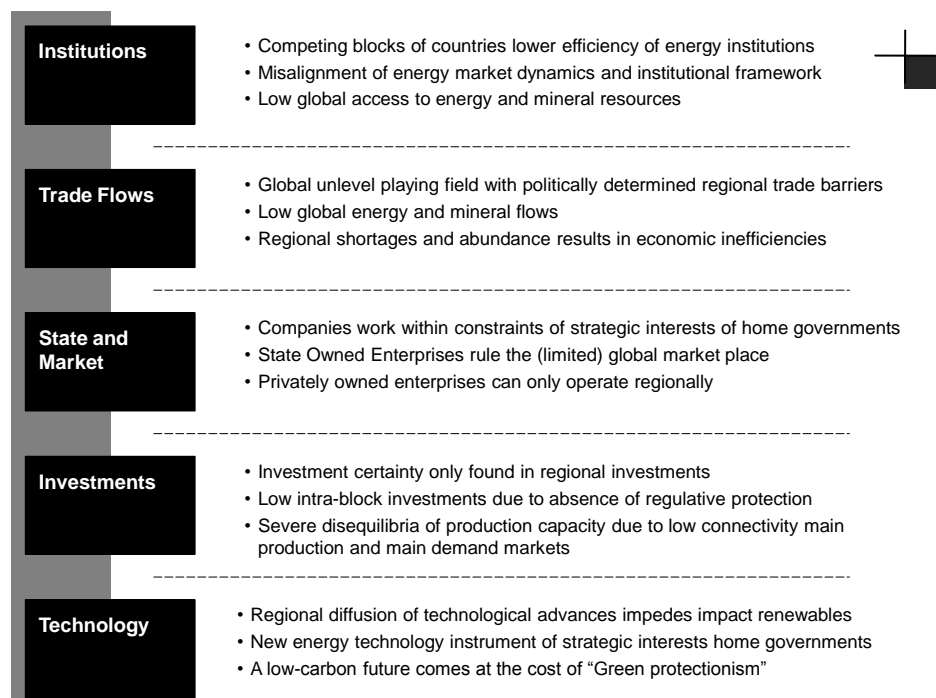
African countries were aligned either with the Indian, Chinese or South American block, very much along geographical lines, in looser formations, and sometimes shifting between alliances. North Africa maintained its orientation on southern Europe. Turkey, Iran, Iraq, and the Caucasus remained restless

and instable, not wanting to choose between one or the other world. They all compete for leadership of a Black Sea Group.

Only water and food remain a problem, although food surpluses of blocks are still traded. Yet the trading of resource surpluses is different from trading for the highest bidder in a free market system, because trade relies heavily on the needs of the domestic economy and the size of strategic reserves. The equilibrium is suboptimal, and security of supply has become costly for the net importing blocks. At the same time, the expenditure on defence is high because of the looming regional conflicts. The stability of the world and within the blocks largely depends on the ability and willingness of the net exporting resource countries to supply the blocks.

Increasing domestic demand for these natural resources in these countries worries the leaders of the other blocks to the extent that they actively try to reduce their dependence on imported fuels and minerals through substitution, domestically or ‘block’ produced renewables and recycling. The political and economic uncertainty in the Pathway period and the subsequent failure of the multilateral organisations to keep the world together had stimulated the sustainable and innovation agenda in those sectors that were perceived as vital for the protection of national sovereignty. Some blocks were more successful than others to create wealth in this new system than others. Particularly the America’s, rich in resources, were successful. Substantially fewer regional conflicts plagued these two continents, lowering the security costs. This was a major advantage compared to the high costs of China and India and to a lesser extent EU.

Figure 5: Development of WP3 themes in Future World Image “Rubik’s Cube”

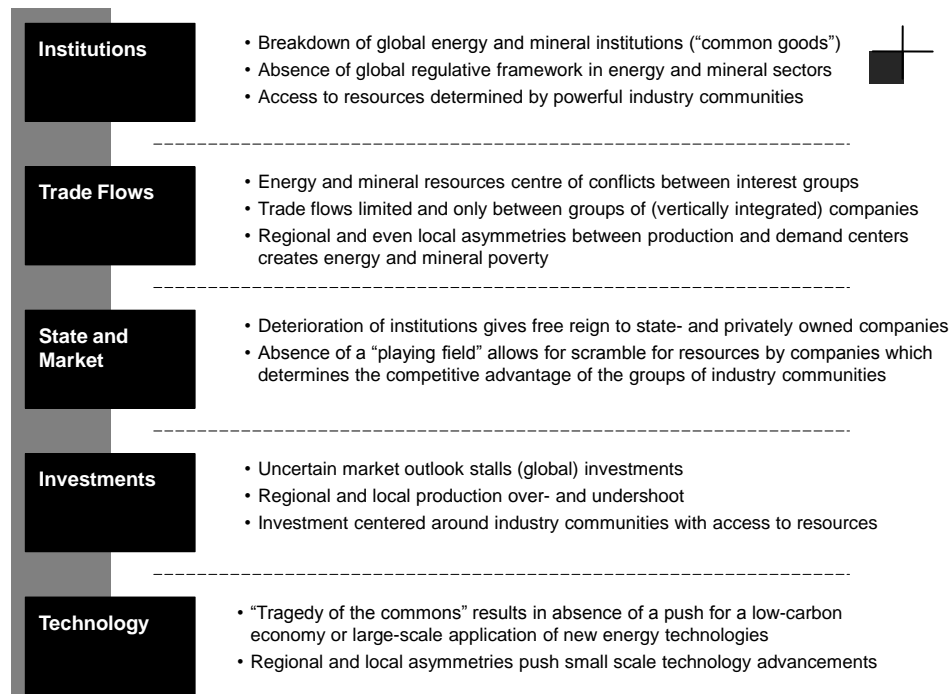


#4 Fracture

In the fourth quadrant the world is struggling with the serious erosion of the rule of (international) law, the weakness of the national state in some parts of the world and the complete integration of the state and economy in others, making a distinction between state or and state company very hard to make. Large private conglomerates compete with state companies for scarce resources and markets. These large companies usually have their own defensive and security forces to secure their interests at home and abroad. The elites running these companies are a merger of the state/political elites and private elites of previous eras. The Great Recession and the inability to resolve the problems had eventually reinforced companies to take care of themselves. The weakening of the states had seriously impaired the multilateral organisations. Some companies had instead replaced these organisations with their own arrangements. The companies increasingly took some of the political functions on board, but the instability of some of these arrangements created much uncertainty.

The economy in many ‘countries’ is organised in vertical and/or horizontal consortia, in Asia known as Keiretsu or Chaebol. Sometimes these organisations are structured like international triads, including their own security forces, particularly in those communities where activities generating very high economic rents activities are contested. With no authorities to uphold the rule of law and the private security organisations, individual rights and local communities find it very difficult to protect their rights without making a choice for one or the other group.

Public goods are scarce; basically the international public space has been privatised or particularised. In some communities, the new organisations are very stable and provide the local communities with a stable environment, but in others, a large degree of lawlessness is rampant. The breakdown of the state comes at a large cost to the security of local communities. Access to health care, schooling, water and other previous public services is linked to being a functioning part of one the large conglomerates. There is a large difference between the efficiency of the conglomerates and the willingness to share the proceeds with the stakeholders. Some are focussed on the short term and do not invest in the schooling and health of current and future workers, while other take a longer view. The companies are the new communities and stretch beyond the old national borders of previous periods, often running along the organisational lines of value chains. Some also include satellite companies and collaborate to organise the public space between them, but none of the previous nations or states are represented in such coherent way. Shared language, religion or political tradition is no longer the organising principle, but is replaced by the logic of the assets of the companies and the consumers they can organise within their value chain. Competition between many of the new ‘societies’ is fierce, and because they also embed the right to use force, many conflicts end in violence. Unfortunately, many of these conflicts centre on natural resources and energy, but also food, and access to technology become contested.

Figure 6: Development of WP3 themes in Future World Image “Fracture”

Oil markets, gas markets and mineral markets in the four future world images

Introduction

The above ground constraints on energy and mineral markets are important factors for supply and demand balances. Both total energy demand and mineral demand is linked to economic growth (see WP2). In the future world images, we assume different economic growth paths. The most optimistic in terms of economic growth are the multilateral cooperative storylines: Bretton Woods 3.0 and Celestial Dragon. The impact of these cooperative storylines on the various players is different though, giving more room for market solutions in the Bretton Woods 3.0 storyline compared to Celestial Dragon where state capitalism (and state companies) plays a larger role. In the market-based Bretton Woods 3.0, economic growth is assumed slightly higher than in the Celestial Dragon because states play a less dominant role in decision making over investment, access to resources and markets. This assumes that allocation decisions can be made based on economic efficiency in the Bretton Woods 3.0 world rather than state efficiency must be taken into account. In Celestial Dragon, national interests could hamper certain developments, when the ‘wrong’ companies or groups of companies, who are not seen as serving the national interests, are attempting to make an investment. It would certainly bias the economic system to favour certain companies seen as representing these national interests.

In the two uncooperative world images (at least seen at a global level), economic growth is assumed to be lower because political balancing plays a dominant role in economic exchanges between various economic blocks. The distribution of economic growth and the benefits and costs that derive from it is very uneven, also among states. Depending on where you are in the system you do well or not.

In Rubik’s Cube, the world is divided in competing blocks, and is very strategic national interest oriented. Particularly energy and mineral resources (including water) are the main bones of contention among the power blocks and seen as strategic resources for the blocks’ economies to function. Competition for resource-rich countries to be part of one block or another is high and because many trade flows are political in nature, the ability of the system to arbitrate along economic lines among the blocks is weakened. Political arbitration or balancing of resource rich and poor countries and blocks takes the upper hand.

In the Fracture world image, the world is also divided but not along state lines because states have weakened tremendously (compared to the current situation), but according to value chain/corporate lines, creating new types of ‘communities’. In the Fracture world, the cost of managing the public space is partly privatised and partly an externality. Depending on being part of a functioning new type of community, groups manage to capture the benefits of growth, while others are locked out. Because the world is economically speaking smaller, the call on resources is smaller too (and emissions are lower). However, access to resources is problematic, and could lead to major conflicts between competing groups. Because the rule of law is weak on a global scale but strong within ‘communities’ these conflicts could more easily spin out of control.

Energy and minerals

Energy demand has a strong correlation with economic growth. The regional/national disparities in economic growth do have an impact on total demand and supply balances, as well as reductions in energy intensity in various regions.

In the **Bretton Woods 3.0** world, energy demand is buoyant. Oil supply has difficulty keeping up with the growth of demand, but other fuels, including renewables manage to fill the gap to some extent. As part of the deal, energy subsidies were abolished, which stimulated energy efficiency in emerging economies and producing countries alike and also allowed more renewables to enter the mix. The restoration of trust in the global economic system also reduced the security of supply costs of the major consumer markets, although not all 'above ground' risks could be downgraded. The most pressing ones in the Middle East and Caspian region were resolved in cooperation.

The fact that international energy cooperation was resumed played a major role in stabilising international relations. China joined the International Energy Agency, and more remarkably Russia and Kazakhstan joined OPEC. Both the IEA and OPEC collaborated closely in the International Energy Forum (IEF), which formed the core of energy cooperation. Also other organisations were feeding the IEF with information, bringing more coherence to the energy dialogues. The IEF managed to include in its new Charter a global agreement on investments along energy value chains, guaranteeing better access to resources, transit and markets, as long as energy technologies were shared and best practises followed. Transparency in demand and supply was one of the fundamental agreements underpinning cooperation and included both fossil energy and renewables. The International Renewable Energy Agency Irena was also included in the IEF family. Fuel wide transparency helped to reduce the investment risk in production, processing and distribution. The sanction of not following the Charter agreement of the IEF was to be locked out from the benefits of investment guarantees and arbitration in case of conflicts. Cooperation in IEF was later also extended to include climate change policies. The approach was different from the earlier attempts at the UNFCCC COP meetings where a global framework was the main aim. Within the more informal setting of the IEF, bilateral and regional pacts lay at the core, and as long as energy efficiency improved and technologies diffused to include all member states, these bottom-up pacts were used to move the 'climate benchmark' each five-year period. This helped to move away from the one size fits all approach towards all sizes to one fit approach.

IOC-NOC cooperation increased tremendously in the first few years and, when once confidence increased in investor behaviour, private investors gained more access to resources. At the same time, NOCs were given easier access to markets. In natural gas cooperation, similar developments took place. The GECF became the counter part of the natural gas department of the IEA in IEF, and they became important pillars of cooperation.

The IEF also began to monitor the financial flows connected to energy trade, making sure that speculation was reduced to a minimum. Special stocks of oil and gas were reserved for release when speculative drives threatened to divorce prices from underlying demand and supply fundamentals. Decisions to release energy onto the market were made in a special market committee, made up of the energy ministers of the 5 largest producers and consumers of a group of fuels (liquids, gases and solids), including renewables.

In the Bretton Woods 3.0 world, risks have been trimmed down to the more normal commercial risks, including volume and price risks. Security of supply issues were discussed regularly at the IEF meetings, and although conservation policies were recognised as useful for producer countries' long term economic management, they had to be discussed in the policy group to make sure that world supply and demand balances were stable enough. National energy policies were deemed important for stability in the economy, but were judged against their impact on world markets. Predictability of demand and supply were held in a high regard, and reduced to some extent the dynamic nature of the resource industries. At the same time, the efforts of countries to stimulate energy efficiency and the availability of alternative fuels helped these discussions because a much more comprehensive view could be developed by bringing all the fuels under one institutional roof. Moreover, the risks are also easier to manage in a world where also other institutions, such as the IMF, World Bank, WTO had all been renovated to deal with the issues of a renewed global economy.

China's oil bill was very large indeed and was the foundation of the country seeking to manage its energy risks through cooperation. Saudi Arabia was interested in translating its oil riches into long term sustainable economic development, requiring the country to manage its domestic energy use much better than in earlier years. Gaining access to new technologies and a sustainable foundation for its oil industry had steered it to cooperation. Also the establishment of a fair system of rent distribution along the value chain made producers, transit and consumer countries more trusting in allowing a more diversified group of investors to explore and exploit the energy resource and operate the systems. The energy efficiencies achievable in the transportation sector were important for the main oil producing countries to promote, extending the life of oil in the energy mix. Moreover, getting deeper access to the emerging consumer markets created more security of demand and a better foundation on which to make its investment decisions. The same was true for Iraq that emerged as a major producer, and they it was also keen to make sure that oil and gas would stay in the world energy mix. Both countries, Saudi Arabia and Iraq were at the core of the new producing country stance in international energy markets, making it harder for other producers to deviate from the policy they supported.

Cooperation on minerals was structured in a different manner, but followed the same logic. The main producing and consuming nations and the large companies created more transparency in supply and demand, reserves and investment plans to reduce speculation in the market. Also the race for equity, developing vertically integrated flows for particular consumer markets, was ended, creating more confidence in market developments. Although the working and structure of the sector remained an oligopoly, the social and political pressure to conform to the new mores of the international markets, took much of the distrust away.

The main risk in the Bretton Woods 3.0 world remained the balance of payment consequences of energy and mineral trade, particularly as a result of short-term disruptions, which could not always be avoided. Countries such as China and India were increasingly confronted with large trade deficits as a result of their energy imports. Efforts to maintain structural equilibrium were not always sufficient. Many countries preferred to develop alternative resources for in order to reduce reliance on imports. As a matter of fact, much of the renewable energy efforts were inspired by balance of payments concerns.

Already in the period before the Bretton Woods 3.0 agreement, resources were in tight supply and most economic rents were captured in the upstream phase of the value chain. Regulation of markets

had reduced the rent collection in the mid and downstream parts in many markets, biasing the industry towards the upstream. Despite the agreement, the uneven distribution of economic rents in the value chain could not be fully repaired. Subsidies on consumption had disappeared but taxes remained. Because governments had agreed to distribute rents fairly to reflect the risks and benefits along the value chain, the taxes squeezed companies' profits in the mid and downstream, reducing the innovative power here and reducing the investment appetite of dedicated mid and downstream companies. In fact, this led to further vertical integration of state companies, while private companies benefitted from the increased access to resources. Also in renewables a similar trend was visible, and technology fuels linked up this mechanism with the mineral sector, forcing many consumer countries to run networks in state companies and absorb the risk. Many companies began to behave like 'producing countries' did in the earlier period, trying to extract the rents from the resource and leave the regulated parts for the state to run. This was most pressing in the electricity sector, but also in oil, refineries were, when not part of a state oil company, run like a utility. In some countries, this was done fairly efficiently, but in some countries not, driving up the cost for consumers.

In the other cooperative world image, **Celestial Dragon**, producer-consumer cooperation is was also important. But because this FWIS is more politically driven, the market is not the main vehicle through which investments and markets are approached, albeit governed by a strong institutional cooperation framework, but Rather they were determined by national interests are. The type of cooperation was much more political and often based on bilateral agreements widened to include other states. The level of comfort in terms of security of demand and supply was somewhat less, because political tension, even when not originating in energy or mineral resource issues, can could easily undermine cooperation. Also cooperation was based on political and market power and less based on trust, posing a problem for smaller players. Cooperation in this quadrant was, therefore, less comprehensive than in the Bretton Woods 3.0 one.

In Celestial Dragon, more political rebalancing took place and economic incentives were subordinated to the arrangements of the states. Economic growth was therefore less buoyant than in Bretton Woods 3.0 and perhaps slightly more regionally uneven, depending on the composition of a group. This resulted in slightly lower demand for internationally traded energy, such as oil and gas, and a bias on towards domestically produced fuels, such as renewables and coal. For the international oil market, the relaxation of demand made it easier to manage the natural decline rate of wells fields with the planning of new wells fields coming on stream. Cooperation between NOC's and IOC's became very important in managing the oil supply and demand balance. China was main security guarantor for energy supply security. Its presence in the Middle East and the Caspian region was testimony to the new mores of the international system. The United States, which was largely self-sufficient in energy, was not the main provider of security of the flows of international energy, but as a partner of China remains active in safeguarding certain African flows.

China's main challenge was to manage its oil and natural gas imports, and it had less interest in bringing other fuels under one institutional umbrella. Since the main foundation of the world was formed by the cooperation between the US and China, cooperation was more focussed on balancing the interests of these two countries. Although, China was a major energy importer, the United States was not. This left much many of the international energy governance challenges for China to manage. China preferred to manage its oil relations on a bilateral footing, and underpinned them with security investments in its navy to patrol the most vulnerable passages in Asia and the Middle East. The

combination of providing the most dynamic growth market for oil and gas makes China, closely followed by India, the mores setter in energy relations.

In the Celestial Dragon world, this implies that state energy companies are the main actors, and IOC's take a backseat or have retreated on into the American market. Only in North America and the Arctic were the IOC's are dominant, while in Australia IOC's and NOC's were both active. European countries have been unable to wield any power in energy relations. They were price and security takers and rely heavily on Russia to balance the power of China. Although, domestic renewables have increased their market share in the European market, energy import dependency remains very high. The main risk for Europe was the occurrence of a short-term volume and price event, which was less difficult to hedge in a less liquid market. In more tight energy markets, the bilateral interests of China take the upper hand, and Europe has a much harder time to attract relatively low priced energy flows into its market, including renewables. In electricity, this stimulates the development of renewable sources, and in combination with the flexibility provided by Russian and Norwegian gas, makes the problem manageable. In transportation, the limited substitution ability of oil is a problem because the electricity system is strained as it is. Battery technology stalled, and the intensity and size of network investments could not be realised in the relatively short space of time and in the circumstances of the Great Recession.

The switch of the US from being a substantial importing country to a near self-sufficient one has led to a virtual withdrawal from the IEA, leaving the Europeans mostly to fend for themselves. Most energy related meetings take place under the flag of the IEF, although, it's informal nature and China's preference to play its own role prevented the IEF from becoming a decisive force in energy relations. The Beijing-Riyadh axis is important for oil governance, while Beijing-Doha-Melbourne is the main natural gas axis. Only in biomass, both the US and Brazil were important counter balancers to China's market power. Europe's idea of 30 years ago that creating an open and competitive energy market guarantees relatively cheap and secure flows has been totally surpassed by the strong politically oriented energy trade of the Celestial Dragon world.

The weakening of the WTO further undermined competitive energy and mineral trade, and long-term agreements between China and its trading partners have become the norm. For smaller players it has become more difficult to access resources through investments, and to organise competitive trade flows for themselves. They have been relegated to the 'left-over' spot market where swing volumes are traded at a premium. China, however, is clever enough to keep this part of the market supplied adequately so that prices, although higher, are not so high that counter forces are organised against China's position. And since China is providing energy security, the price premiums are seen as a contribution towards security of delivery.

NOC's in both energy and minerals dominate the market. IOC's have been relegated to North America, and as such hardly qualify for the name multinational. They have withdrawn from most European markets. European countries have set up some national and sometimes bi-national importing state companies to handle energy imports, but most of the market is divided among state companies from producing countries. Power companies were nationalised after a big crisis in Europe in the late 2010s, and were run like utilities again. This made it easier to increase renewables in the power mix without resorting to complicated market-based subsidy schemes. Market-pull innovations were

transformed into technology push schemes, and although theoretically, more expensive for consumers, they became a reliable source of electricity.

In minerals the same structure applies. With North America virtually self-sufficient, China is the main regulator of rest of the world's mineral trade and investments. Others have no option but to fall behind the main actor in the market. Because China is so dominant in structuring international relations and is providing security in the Pacific, they shape most markets, including the financial market. Institutions are plied to serve these interests. Interestingly, more and more countries that find themselves outside the Chinese 'mainstream' of interests are finding new ways of organising themselves. Particularly small-scale energy and mineral technologies, not interesting for China's vast needs are forming a very dynamic alternative market. The US and Brazil are becoming very interested in these developments and they are providing risk capital in addition to local investors. Particularly, cradle-to-cradle type of investments and multiple applications moving resources in an efficient way in the value and wealth creation chain become a source of local growth. Waste becomes a major resource for these countries, and recycling a new art in growth. The main actors are Japan, Korea, Thailand, Malaysia, some North European countries, Spain, Portugal, Iceland, Morocco, Tunisia, Egypt, Zimbabwe, and Zambia. These countries are geared towards developing alternative models of growth, and developing new strategies to manage their resource needs. In effect, they become an important counter force to China's power, and activate the US to become some sort of broker between the two worlds.

In **Rubik's Cube**, the world becomes not only more politicised than in the Pathway, but also more disorganised. The world is divided in competing blocks, where not one nation is strong enough to become the mores provider. Multilateral institutions have become mostly paper tigers, not a meeting place of decision makers. They function at best at low levels of authority, and have been stripped of political legitimacy. International relations are bilateral and although relations between the strongest in a block matter, no rules or agreements are ever concluded on which international trade and investment across blocks can prosper. Economic growth is low, which is reflected in international trade and investment. Many countries have resorted to trade barriers and only when the blocks are somewhat stable do inter block exchanges begin to grow. Food and water shortages afflict many countries when rivers running through multiple countries are blocked or siphoned off elsewhere. The energy and mining industries are suffering from these shortages too, and production in some countries has become problematic. In many countries the hope of growing sufficient biomass to compensate for the lack of access to oil and gas are dashed. The inability to trade and exchange technologies across blocks is hampering both fossil and renewable markets. In many countries, the energy and mineral industry has been nationalised due to the new political situation and the shortages in basic needs. IOC's have been relegated to a few regions where nationalisations have not been part of the policy envelope, but it is clear that the companies function within the constraints of the home governments' strategic interests.

Most of energy trade and investment takes place within blocks. Resource-rich countries become highly contested among leading powers, and particularly Africa becomes a battle ground for inter-block rivalry over resources. Access, price, volume, liquidity on a world scale are problematic. Russia has great difficulty to maintain its sovereignty in its Eastern provinces. China has made various attempts to take over that over that part of the country, and only nuclear threats stopped the Chinese from pursuing these Eastern Russian resources. An alliance with Northern Europe, and active population policies helped in restoring a power balance along the border, although Central Asia could not be 'saved' from Chinese influence. Russia agreed to supply the Chinese markets, but on its own terms, reserving

ownership for Russian companies. China has manoeuvred the East Caspian Sea firmly into its political orbit, and also Iran joined for strategic reasons. The other countries in the Persian Gulf opted first to maintain neutrality, trying to broker for a role supplying the various blocks. But the oil hunger of China led in part to a *de facto* membership of the Chinese led block. They nevertheless continue to ship oil products to other markets, particularly through the new southern corridor linking Saudi Arabia with Kuwait, Iraq and Turkey, keeping the Mediterranean market open. China only wanted crude oil shipments to feed its own refineries. Exporting oil products and GTL to westbound markets was China's way of balancing international economic relations, and securing Saudi crude for the Chinese market.

Turkey developed into an important hub for Middle East oil and gas shipments. The sea-lanes along the coast of Yemen all the way to Kenya, and sometimes as far south as Mozambique, were so dangerous and the security costs so high that many shippers preferred the more expensive overland route to reach other Middle East, North African and European markets. The ability to continue to deliver some product to various blocks was important to maintain some balance in the world, but energy costs have risen dramatically in Europe.

The breakup of the world market into competing blocks had stimulated Europe to re-intensify its efforts to finalise the political union. The strategic alliance with Russia had brought stability on its eastern borders. The loss of the eastern Caspian to China had refocused Russia's foreign policy, and they now actively cooperated with the EU to maintain stable relations in the West Caspian/Caucasus region. Turkey also played an important role. Turkey had decided to stay outside the EU, but had instead opted to create a free trade zone with Russia and the EU. Its position as an important energy hub for Middle Eastern oil products and gas had further solidified its strategic position in the Mediterranean region. The Mediterranean region prospered in the shrunken world of Europe, and they finally managed to become important trading partners of the EU. Their exports of electricity were growing, and industry was springing up close to the solar energy farms to convert the electricity in goods for the European market. Increased employment opportunities had reversed the immigration flows, and the North African countries were prospering.

Minerals and energy in Africa were highly contested between China, Europe, Brazil and the US, but as was its biomass potential. Yet, both Brazil and the US were not prepared to go beyond economic competition. Most security issues were between Europe and China, and the proxies of both blocks. The age of prosperity had been too short for African countries to develop strong domestic institutions and political maturity, and many countries fell prey to pressures of from the competing blocks. The ability to translate its resources into African wealth was weakened by the strong-arm tactics of the competing blocks. Without a world community watching over the exploits of foreign armed forces and companies, a winners- takes -all mentality destroyed many communities. Only a few countries resisted the pressure of these foreign forces, and maintained sovereignty over their resources. Zambia in particular was a good example, but also Botswana and Mozambique. South Africa had early on committed itself to the Chinese block, and often played a proxy role for Chinese interests in other African countries. Particularly Congo was a large prize to be won for the Chinese block with its vast resource potential. Tension ran very high in the sub-Saharan region.

North and South America had formed their own natural block, and resembled the 'old world order' the closest. It still was home to IOC's and the market economies were, with some adaptations, left intact.

The social revival after the Great Recession had shaved off the sharpest edges off capitalism, and resources in South and North America were exploited with more care for local communities. The economic devastation of the Great Recession and the social upheaval that followed had resulted in an inward looking approach. The North and South American block was large enough for the economies of the countries to function at a relatively high level of prosperity. Earlier attempts by China to pry away some South American countries out of the block had failed. The socio-economic contract governing American relations was too attractive to risk in a political battle for influence. Chinese holdings were slowly unwound, and China lost its grip on South American resources.

Australasia was too important not to bring under the influence of China. Although Australia had resisted commitments to the Chinese block, the string of conflicts that the Chinese were willing to fight, had broken its resistance. Its economic ties with China were so strong, that it was impossible to change course. China developed many resources in joint venture with Australian companies, and together they exploited much of the resource potential in Asia. India remained an important contestant of Chinese power, but a long conflict with Pakistan had weakened the country too much for it to develop into a real counter force to China. With the extension of Chinese power into the Eastern Caspian and Iran, Afghanistan, Pakistan and India were isolated, and the only recourse was to fall behind China in stabilising the region. India recovered quickly, but both Pakistan and Afghanistan remained unstable countries. Other South Asian countries had also tried to resist China's mores but quickly found out that they were not strong enough to resist the pressure to fall in line. The diversity and lack of cooperation among the South Asian countries had left this region weakly organised. It had made it easy for China to discipline these countries into its mores. The mix of state and state like companies (run by politically powerful families) were quickly absorbed in the Chinese structure. The predominance of Chinese elites in these countries did create a large source of social-racial tensions when China allied with these minorities in many Asian countries.

In **Fracture** there is not one order, but many. The state in general has become very weak, with a few exceptions. Economic growth is tied to successful groups or communities, often organised as companies along (part of) a value chain. They resemble Zaibatsu's or Keiretsu's and they stretch across geographic regions. They provide their own security. The economy has become the sole organising principle, and although assets can be sold from one group to another, the owner(s) are important providers of stability and prosperity for the people belonging to a group. Without a state providing for law and order and contractual sanctity, the strength of the group is all-important to exploit energy and mineral resources. Transparency is lacking because groups do not have to publish their results and all state-like functions have been internalised into the groups of companies. Some groups manage to function without experiencing much energy or mineral scarcity, but others are struggling continuously. It is a great source of tension, land and mine grabbing often occurs.

Because there is no a global common anymore, further concentration into groups is often the only way out for resource starved groups. People that fall outside a group or community are forced to live like vagabonds, and the number of groups migrating from one region to the next, in search of a place to survive is growing. They are a source of great instability and they often are met with violence. Cities that are important to groups have been closed for non-group members. People that fall outside the 'system' live in empty quarters in great poverty, i.e. regions where no assets worth exploiting are found. Since schooling and health care has been privatised and absorbed into the groups, many people live without any care or social structure. A counter movement soon spring up in these lost

communities, where subsistence agriculture prevails. The ingenuity of some of these communities to survive with little or no commercial energy or mineral resources is the cradle of some energy efficient inventions. The ability to live side by side, in relative stability determined the success of the alternative groups. The ability and willingness of the large groups to use force to bring the more successful alternative groups into the larger group stimulates the more successful alternative groups not to advertise their inventions too widely. The exchange of information and technology is very low indeed. Because the large groups are based on power and hierarchy, they are fairly static and little innovative. Their main concern is to hoard assets for the group and not how efficiently they are used. Only when challenged by other communities or groups does innovation become more important.

Conclusion: identification of key future risks

The previous sections have analyzed five major themes and four future world images in order to distil the main global challenges relating to competition for access to oil, gas and mineral resources for key market participants (private and public). Taking the developments discussed in each of the five themes into account and the actor behaviour over time as described in the Future World Images, we are able to derive certain challenges, opportunities and risks in the future. In Work Package 4, the risks to and opportunities for cooperation are further developed. Here they are presented in support of the work in the next work package.

Context of future risk analysis

In 2011, the renewed interest in the nuclear industry as a low carbon and import management solution was dampened by the Fukushima disaster after the earthquake and tsunami. Japan managed to compensate for its loss of nuclear power capacity by increasing its natural gas imports. The fact that natural gas could play an important role in mitigating the impact of the loss of power capacity in such a large economy was due to the large capacity built up of LNG in recent years and the fact that shale gas was effectively blocking its entry into the US market, making large amounts of LNG available for countries such as Japan. Nevertheless, the Fukushima disaster has created another period of uncertainty for the nuclear industry. New reluctance with regard to investment decisions for new nuclear plants (and technologies), is risking the cohort of old plants to stay open beyond their economic and risk management life. In Germany this risk was quelled by very quickly after the Fukushima disaster to reverse the recent decision to keep old plants open until 2021. Instead, several of the oldest plants were immediately closed and the remainder of nuclear capacity will be closed by 2021. Germany will terminate its nuclear power generation in ten years time. Switzerland followed. Instead, targets for renewable shares in electricity generation were laid down in legislation. In other countries, the difficult financial and economic situation in addition to the disaster in Japan has ground new investments in nuclear but sometimes also other power plants to a halt. These events are hard to predict, have a low probability, but have a large impact on OECD energy policies and investments in the years after. In emerging countries the interest in nuclear power has not yet changed. The promise of a large base load plant with low carbon emissions and a relatively low import risk (but instead a nuclear waste management risk) is still attractive to some energy intense emerging countries.

In recent years, both mineral and energy markets experienced buoyant demand from emerging countries, in particular China and India. Their growth coincided with a growing interest on the part of the OECD countries for rare earth materials, needed for the renewable energy industry. The high prices for minerals and energy in the period up to 2008 attracted a lot of strategic political attention. The subsequent decision of China to limit its exports in some minerals created a lot of concern among the main importers. The near monopoly position of China in rare earth materials had created strategic import dependencies, but high prices had attracted investors in Australia and the US to increase production. Despite the political concerns, the market responded with new investments and rare earth supply will soon reflect the changes. Nevertheless, some countries filed a complaint against China for its trade practises.

The expansion of demand for energy and minerals from emerging countries has made producing countries strategically important again. Governments of these countries try to maximise their revenue from these resource industries. They increase their share of the rents through taxation or ownership or both. Sometimes national companies pursue strategies that give them access to markets, competing with domestic producers in the downstream parts of the value chain. The rate of adjustment required of both foreign and domestic producers often decides the level of protection a government is willing to offer. When national companies are involved in replacing domestic producers, governments sometimes attempt to prevent the changes to take place because do not want a foreign government owning strategic assets in their economy.

Many of the strategic discussions on energy and mineral resources prior to 2008 sounded like repeats of the 1970s. Also then there was a general scare in OECD countries that minerals and energy would deplete soon and that foreign governments would have too much influence over their economies. The scarcity of resources discussion was very much a strategic and power discussion, rather than an economic organisation discussion.

More often than not, shortages or tight markets are temporary and much more a function of local environmental rules and the general investment climate than that they are based on geological depletion. Both the LNG sector and the shale gas revolution have shown that technology can, once the economic climate is right, quickly unlock new potential. This is true for both energy and minerals. The acceptance of new technologies is however not a given. Very often the acceptability of technologies is overestimated, depending on how the local footprint of technologies is handled and how the local risks and benefits are distributed.

International institutions have been challenged to deal with the shifting gravity in international energy and mineral markets and price volatility. 2008 was an exceptional year, where prices of all commodities were high. In July 2008 a special meeting was organised at the invitation of King Abdullah in Saudi Arabia to discuss high oil prices. This meeting and a follow up meeting in December of that year were important landmarks for cooperation because oil consuming and producing countries managed to discuss the policy options of both very high and very low prices. In 2011 the International Energy Forum celebrated its 20th anniversary with a new Charter. In this Charter, among other things, cooperation between the International Energy Agency and OPEC is specifically mentioned. Also transparency on energy data will be improved, creating better insight for international markets in production, reserves, stocks and consumption around the world. More than 80 countries have signed up to the IEF Charter. The strength of IEA and OPEC has declined for different reasons, but they maintain important functions in governance. They do not represent all the producer or consumer interests or cannot or will not share the policies of the member states. Also new important consumer countries are not represented. In IEF a broader representation of old and new energy interests are found but the question is if this rather informal organised organisation will be strong enough to handle the centripetal forces in the energy markets.

In the run up to the financial and economic crisis investments had been booming in both the energy and mineral sectors. Producing countries saw their income from exports gyrate from the very highs of mid-2008 to the very lows at the end of the year and part of 2009. Such wild swings can easily undermine the confidence of (smaller) investors. Only very large companies manage to stay largely on track with their investment plans.

The Arab Spring of 2011 is another challenge for the energy industry. New and old governments alike will be pressed to create more growth and jobs in their own economies and social investment may compete with investments in resource sectors.

The surge in domestic demand in some producing countries is challenging their export capacities, which is unsettling consuming countries. The main question in both energy and minerals is if supply growth can keep up with projected demand. The announcement of the Chinese government that economic growth in the country would slow down to around 7% could provide some respite for the resource industries. The danger of a new ‘super cycle’ in energy and minerals is possible when economies would recover and the new supply opportunities would be insufficient to match demand. The shale potential of China could be important to reduce the pressure on international markets.

Africa’s rise as an important supplier to world markets is evident, but competition for their resources by the major players will be harsh. The risk is that competition for resources increases the political conflict in the region, particularly when these new producing countries continue to have weak institutions.

The way the crisis in the Eurozone plays out will have an important effect on the future energy and mineral demand. Will the crisis be resolved with more or less EU policy-making? Can the EU adjust to a more strategic/political type of world order, where state capitalism plays a larger role? Will European companies be strong enough to compete in such a differently structured world? Will Europe become an energy outlier or adjust its policies more in line with the rest of the world.

Key risk indication from current and recent practices and strategies of key actors

Access to energy & mineral markets and the role of institutions and governance (theme 1), will remain an important issue in energy and mineral markets, regardless of the regime. The economic rents in the resource sectors will remain contested between the various market players and governments. International institutions may work on managing the extremes of the rent-seeking behaviour and develop joint mitigating policies.

Energy and mineral trade, capital flows and the changing distribution of rents in the value chain (theme 2), have created new interdependencies in the world. With the integration of the emerging countries into the world economy comes an increase in, for instance, the oil bill (see Part I Figure 6: Global oil imbalance of payments (2000-2010)). These new dependencies will impact the international relations among countries if security of supply (and demand) is not handled properly. Confidence in each other energy policies and consultation when major changes occur should help to avoid policy competition.

State and private ownership drivers (theme 3) are different, although certain strategies make the boundaries between state and private companies more vague. Vertical integration is not a new phenomenon in the energy and mineral sectors. Backward and forward integration of national companies is also not new. Ending segmentation of the market was one of the aims of the drive for liberalisation of the Washington consensus, but ran against the individual state interests. The income from resources can be very significant. In terms of reserves and production capacities, national companies are the largest, but in terms of revenue and capitalisation private international companies are the largest.

Technology (theme 4) is not a risk in itself, rather there are technology-related risks. In line with a general trend towards globalization and ever more complex value chains, technological knowledge is also diffusing rapidly. The advance of China in renewable energies is remarkable, although particularly the European industry, which developed some of these technologies, is unhappy they could not benefit longer from their technology expenditures. The financial and economic crisis and its aftermath (theme 5) have created opportunities for foreign investors to buy some of these technologies.

The identification and assessment of major future risks of tension and conflict

Based on insights developed in WP1 and 2, and the analysis in WP3, we can derive risks related to the changing geopolitical and geo-economic world order. From the historic analysis (see WP1 main deliverable) we learned that often markets are often quite capable of solving bottlenecks, through substitution or by moving to the next marginal supply available.⁴ Yet strategic interests of governments often influence these markets. Government involvement can skew resource allocation based on source, geography and optimal factor allocation. Last, trust is a key feature of an international system and institutional framework. The trust in the system that the major powers can or wish to generate is important for investments to come about and trade to occur.

The **Pathway** has shown that risks such as price and volume risks are likely to become more pronounced in the period leading up to 2015/2020, also as a result of uncertainties and lower trust around institutional frameworks of energy and mineral markets. Economic uncertainties are consequently compounded and as a result volatility could be very large and economic and fiscal risks are increasing in certain countries. Trade flow asymmetries, as mentioned in theme 2, such as balance of payments problems of some countries are of particular concern because energy and mineral trade volume and price risks could greatly impact growth and the need to structurally reform economies. Moreover, given the short lead-time, there is very little they can do policy wise to hedge against these risks. The current low natural gas prices in the US create important competitive advantages and may help economic and employment recovery. Investments in energy and minerals in the US have increased in the past few years and although the current price is very low, the return on investment in natural gas can be realised through the robust oil prices (natural gas liquids). Also in Australia investments have continued to grow with the expanding Asian market as the main driver. The rewards for upstream investments continue to outstrip the investments in the downstream parts of the industry. In crude oil refining the shift to the Middle East and Asia is continuing, while capacities in Europe are restructured. While the share of natural gas in the energy mix is growing in many countries, in Europe the role of gas in the mix is less certain. In both Asia and North America the availability of gas and the reduction in emissions that can be realised this way are important drivers for investment.

The uncertainty in Europe about the role of gas in the low carbon economy is more opaque due to political factors. The fact that Europe will become a major importer of energy and the structural dependence on producing countries is creating a discussion on security of supply. The fact that due to LNG and the shale gas revolution supply become much less concentrated on but a few exporting countries has not changed the policy position of the Commission (yet). The dependence on Russian supplies is seen as problematic even though new LNG flows and the potential for shale gas on the

⁴ POLINARES D1.1 report (http://www.polinares.eu/publications_deliverables_d1_1.html),

European continent could change the balance. Instead, Europe is aiming to fast track renewable energies, although the fiscal crisis in many European countries may make the introduction of these fuels more difficult when subsidies have to be slashed. The main risk for Europe is that energy and mineral trade will not take place in a level-playing field and that other economies will be more able to diversify their energy sectors or negotiate special access. Also Europe runs the risk to become engaged in a subsidy race, both internal and external, skewing investments, despite the agreement to abolish subsidies in the G-20. The plans to create a low carbon economy while maintaining an open market, also in minerals, is difficult to reconcile and could impact on international relations.

For the longer term future, the **Future World Images (FWIs)** show that different types of risks might be encountered depending upon the direction in which the international system develops itself. The Future World Images deal with the overarching context in which the risk categories must play out in different governance and strategic/political surroundings. The security costs may differ widely, while also flows and volumes may be affected.

In the **Bretton Woods 3.0** FWI, global governance structures will be modified relative to today's institutions but retain the core elements of the liberal/free-trade capitalist system as proposed by the original versions set up by the United States in the 20th century. Other countries will take a more prominent role. It is likely that energy producing countries will be at the core of these discussions. The US and China are both substantial producers and consumers, and therefore will take a prominent position in the governance landscape. It is unclear what the role of Europe will or could be, other than offering an attractive market for producers to sell their products in. The way in which the low carbon energies function in the market will be crucial.

In such a world, helped by a coherent institutional framework for energy and mineral resources, physical energy and mineral flows and subsequent monetary flows are efficiently allocated and reallocated. In such a world, the price and volume risks will likely be less severe due to the existence of working governance systems to deter free-riding and manipulation of the resource markets. The main risk is that demand will outpace supply growth, despite greater trust and access to resources. The rejuvenation of the global governance system along the liberal market economy lines will spur new investments to take place and allow for deeper NOC and IOC cooperation. From a technological perspective, we see a clear global push for a low-carbon economy also due to support by high diffusion of new energy technologies. An inherent risk here is that technology breakthroughs, helped by high diffusion, have the potential to cause severe market fluctuations and short- to medium term disequilibria.

In the **Celestial Dragon** FWI, global governance structures are determined to a large extent by China, which will have emerged as a new global rule-setter, with the US as an important balancer. Albeit coherent, the global governance structure is strategic and geopolitical / geo-economic in nature and form a strong driver of state-participation in the marketplace. The impact upon resource markets and the institutions governing them will come from China's management of its import dependency upon energy and mineral resources, China's subsequent import bill and its desire to diversify import sources to mitigate Security of Supply risks. Africa's resources become more contested, but Europe's role is limited. The US will endeavour to keep Africa's resources available to the world market, which may be important for Europe. Due to unconventional oil, gas and coal, and the development of some

domestic renewable resources, Europe has to carry a larger share of its own security of supply costs. Competition for resources with China will be a main theme.

Liquidity of some resource markets will decline, when NOC-NOC cooperation becomes a leading structure and trade flows more 'organised' along national structures. In parallel, global trade flows are dominated by Security of Supply or Security of Demand prerogatives and fragile due to the strategic and political importance it is given. Also investments reflect the national interests with states pushing for locally produced fuels such as coal and renewables. The North American market remains an 'island' of competing businesses. Managing imports and exports becomes a leading theme for many countries around the world, and renewable energies are stimulated mainly when they can either provide more diversification to imports or replace imported fuels. The risk is that national interests do not match the availability of varied import options and that renewables cannot fill the gap.

In the **Rubik's Cube** FWI, the world becomes much more regionally organized, and the importance of alliances for access to resources is crucial. Low global energy and mineral trade flows as a result of high regional trade barriers creates regional with abundant resources and regions with deficient resources. As a result, volume and price risks increase, and security of supply costs increase substantially. Russia becomes a crucial supplier for Europe and a political balancer with China. North and South America become an important self-sustaining block, where both IOC's and NOC's function side by side. Access to resources in the short and the longer terms is uncertain, depending on the alliance and the importance to be part of an alliance. In a highly politicized world, domestic resources will play a bigger role in both production and consumption, and in technology developments. Perhaps surprisingly, new energy technologies receive a big push by home governments in search for domestically produced fuels.

The division into regional blocks is an unstable world because many countries will try to balance against too much power for accumulating in one or the other block. It is not unlikely that the Middle East may become one of the regions trying to balance its interests between all the blocks. The risks are insufficient investment opportunities in minerals and energy and politicisation of investments. Access to resources will be determined mainly along alliances/bloc lines. Business-to-business will be largely replaced by government-to-government approaches. International markets function very poorly and are limited in size and scope. The risk is that resource-rich blocs will dominate international affairs and resource-poor blocs see their powers reduced.

In the **Fractals** FWI, many risks will be internalized along value chain/ corporate lines, but with the consequence that many citizens could become excluded from these 'communities'. All the risks can be brought back to one major risk, social cohesion is high within the new type of communities, and low at the level of previous nations, peoples, religions, language groups, etc.; you belong or you do not belong and therefore you have or have not. The risk is that the global common is not maintained and that fragile environments are not protected.

The absence of a level playing field for energy and mineral markets and subsequent investment uncertainties stall global investments. As a result, we see a regional and even local over- and undershoot of energy and mineral production capacities, resulting in significant regional asymmetries. As the division between state- and private companies deteriorates, we see companies organising themselves around industry communities which have free reign in the "marketplace". The low level of

investments made is done within interest groups and often towards a particular fuel. The “tragedy of the commons” results in the absence of a push for a low-carbon economy and large-scale application of new energy technologies.

Overall, we see that price and volume risks are a recurring theme in all future world images, although the degree to which will differ. Yet other risks, such as the declining role of IOC’s occur mostly in the more political oriented scenarios. In both cooperative worlds we can see IOC’s and NOC’s working side by side, albeit in different contexts, but in the more uncooperative world (on a global scale) the loss of governance either reduces markets to smaller regions/units of organization, or make it a unregulated somewhat rough world. Renewable technologies could be advanced through a climate agenda or by a security agenda, where more emphasis on domestic sources is crucial. The distribution of technology to other countries will differ in relation to the drivers.

Summary bibliography (Part I and Part II)

Aissaoui, Ali, 'Fiscal Break-even Prices : What More Could They Tell Us About OPEC Policy', in: *APICORP Economic Commentary* (2011).

Agt, Christof van, 'Tabula Russia', in: *Clingendael International Energy Programme* (September 2009).

Barclays Commodity Research, *Global Energy outlook: Oil upside, Rising CAPEX* (2012).

Birdsall, Nancy, and Francis Fukuyama, The Post-Washington Consensus, in: *Foreign Affairs* (March/April 2011).

Bloomberg New Energy Finance, *Global Trends in Renewable Energy Investment 2011* (2011),

BP, *Statistical review of world energy* (2011).

BP, *Outlook of World Energy 2030* (2011),

Buijs, Bram and Henrike Sievers, 'Critical Thinking about Critical Minerals', in: *Clingendael International Energy Programme (CIEP) Briefing Paper* (November 2011).

Buijs, Bram and Henrike Sievers, 'Resource Security Risks in Perspective, in: *Clingendael International Energy Programme (CIEP) Briefing Paper* (November 2011).

Buijs, Bram, 'China and the Future of New Energy Technologies', *Clingendael International Energy Programme Energy Paper* (March 2012).

Campaner, Nadia, Shamil Yenikeyeff, *The Kashagan Field: A Test Case for Kazakhstan's Governance of Its Oil and Gas Sector* (October 2008).

Dam, Kenneth, *The Rules of the Game, Reform and Evolution in the International Monetary System*, The University of Chicago Press, Chicago, Ill., (1982).

Dannreuther, Roland, "Understanding Conflict, Collaboration and Competition over Access to Oil, Gas and Minerals: An Overview and Summary", POLINARES Working Paper no. 1, September 2010.

Dicken, Peter, *Global Shift: Mapping the Changing Contours of the World Economy*, Sage Publications, London, (2007).

EIA, *Performance Profiles of Major Energy Producers* (2011).

EIA, *Effect of increased natural gas exports on domestic markets* (2012).

EIA, *Energy Today* (28 March 2012).

Ernst & Young, *Global oil and gas tax guide 2011* (2011).

Erten, Bilge and José Antonio Ocampo, 'Super-cycles of commodity prices since the mid-nineteenth century', in: *UN DESA Working Paper* (2012),

European Photovoltaic Industry Association, *Global Market Outlook for Photovoltaics until 2015* (2011).

ExxonMobil, *Outlook 2040* (2011),

Fattouh, Bassam and Coby van der Linde, Twenty Years of Producer-Consumer Dialogue in a Changing World (IEF).

FEEM, Monitor, *Braving the New World: SWF investment in the uncertain times of 2010* (2011).

Ferguson, Niall, Complexity and Collapse, Empires on the Edge of Chaos, in: *Foreign Affairs*, March/April 2010.

Financial Times, *Let the gas flow* (26 March 2012).

Frankel, Jeffrey, 'The Natural Resource Curse: A Survey', in: *NBER Working Paper No. 15836* (2010)

Gilpin, Robert, *Global Political Economy: Understanding the International Economic Order* (New York 2001).

Glaser, Charles, Will China's Rise Lead to War, in: *Foreign Affairs*, March/April 2011; Colombia University, *The Rise of BRIC: Impact on global policy making*, Inaugural BricLab Conference, 2 December 2011 (2011).

Global Wind Energy Council (GWEC), *Global Wind Report 2010*, April 2011.

Goldthau, Andreas and Jan Martin Witte (eds.), *Global Energy Governance, The New Rules of the Game*, Brookings/GPPI, (2010).

Heydon, Kenneth and Stephen Woolcock, *The rise of bilateralism: Comparing American, European and Asian approaches to preferential trade agreements* (New York 2009).

Hulst, Noé van, *The Last Waltz: Reflections on Past and Future of the IEF* (2011),

IEA, *World Energy Outlook* (2011),

IEA, *Special report World Energy Outlook 2011: Are we entering a golden age of gas?* (2011),

IEA, *Monthly Oil Review* (March 2012).

Jaffe, Amy Myers and Ronald Sligo, State-backed Financing in Oil and Gas Projects, in: Andreas Goldthau and Jan Martin Witte (eds.), *Global Energy Governance, The New Rules of the Game*, Brookings/GPPI, 2010.

Karl, Terry Lynn, *The Paradox of Plenty, Oil Booms and Petro-States*, University of California Press, Berkeley, 1997.

Kenen, Peter, *Managing the World Economy, Fifty Years after Bretton Woods*, Institute for International Economics, Washington D.C., (1994).

Kramer, Andrew, 'Shell cedes control of Sakhalin-2 to Gazprom', in: *International Herald Tribune* (December 21, 2006).

Krugman, Paul, *Currencies and Crisis*, The MIT Press, Cambridge Mass., (1993).

Ma, Xin and Philip Andrews-Speed, The Overseas Activities of China's National Oil Companies: Rationale and Outlook, in: *Minerals & Energy*, vol. 21, no. 1, (2006).

Marcel, Valérie and John Mitchell, *Oil Titans: National Oil Companies in the Middle East*, Chatham House/ Brookings Institutions Press, London/Washington, D.C., (2006).

Martinot, Eric and Li Junfeng, 'China's Latest Leap: An Update on Renewables Policy', July 21, 2010; The Climate Group, 'China Amps Up Renewables Targets' (2011).

National Development and Research Commission, Medium and Long Term Development Plan for Renewable Energy in China (2007).

Newell, R., presentation Energy Outlook 2011, EIA June 2011.

Noreng, Oystein, *Crude Power, Politics and the Oil Market*, I.B. Tauris Publishers, London/New York, 2006.

OPEC, *Who gets what from Imported Oil* (November 2011),

Roubini, Nouriel and Brad Stetser, *Bailouts or Bail-ins? Responding to Financial Crisis in Emerging Economies*, Petersen Institute for International Economics, Washington D.C., (2004).

Sampson, Anthony, *The Seven Sisters, The Great Oil Companies and the World They Shaped*, Viking Press, New York, (1975).

Stevens, Paul, *The 'Shale Gas Revolution': Hype and Reality*, Chatham House, September 2010.

Stubbs, Richard and Geoffrey Underhill, *Political Economy and the Changing Global Order*, London, MacMillan, (1994).

Turner, Louis and Neil McMullen, *The Newly Industrializing Countries: Trade and Adjustment*, The Royal Institute of International Affairs, Allen & Unwin (1982).

UBS Investment Research, *Global Mining Taxation: Who will follow Australia's lead?* (May 2010).

Waltz, K.N., Structural realism after the Cold war, in: *International Security*, vol. 25, no. 1, (2000).

Wendt, A., *Social Theory of International Politics*, Cambridge, Cambridge University Press, (1999).

Daniel Yergin, *The Quest*, Allen Lane, London, (2011).

Zunes, Stephen, 'The Dubai Ports World Controversy: Jingoism or Legitimate Concerns?', in: *Foreign Policy in Focus* (2006).

Zweig, David, and Bi Jianhai, China's Global Hunt for Energy, in: *Foreign Affairs*, vol. 84, no. 5 (2005); Ian Taylor, China's Oil Diplomacy in Africa, in: *International Affairs*, 82: 5 (2006).